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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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WEDNESDAY

MARCH 8, 2017

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ROCKVILLE, MARYLAND

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

COMMITTEE MEMBERS:

DENNIS C. BLEY, Subcommittee Chairman

RONALD G. BALLINGER, Member

CHARLES H. BROWN, JR. Member

MARGARET CHU, Member

MICHAEL L. CORRADINI, Member

WALTER L. KIRCHNER, Member

JOSE A. MARCH-LEUBA, Member

DANA A. POWERS, Member

HAROLD B. RAY, Member

JOY L. REMPE, Member

PETER C. RICCARDELLA, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

MATTHEW W. SUNSERI, Member

DESIGNATED FEDERAL OFFICIAL:

MIKE SNODDERLY

ALSO PRESENT:

AMIR AFZALI, Southern Nuclear

STEVE BAJOREK, RES

DAVID BLEE, USNIC

AMY CUBBAGE, NRO

PETER HASTINGS, NIA

JIM KINSEY, INL

JAN MAZZA, NRO

WILLIAM RECKLEY, NRO

JOHN SEGALA, NRO

MICHAEL TSCHILTZ, NEI

*Present via telephone

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P R O C E E D I N G S

8:30 a.m.

CHAIRMAN BLEY: The meeting will now come to order.

This is a meeting of the Future Plant Design Subcommittee of the Advisory Committee on Reactor Safeguards.

I'm Dennis Bley, Chairman of this Subcommittee.

ACRS Members in attendance today are Ron Ballinger, Charlie Brown, Mike Corradini, Walt Kirchner, Jose March-Leuba, Dana Powers, Harold Ray, Joy Rempe, Dick Skillman, John Stetkar and Matt Sunseri.

Mike Snodderly is the Designated Federal Official for this meeting.

Today, we have members of the NRC staff and members from the nuclear industry to brief the Subcommittee on NRC's Non-LWR Vision and Strategy Implementation Accident Plans and supporting activities.

The NRC staff has been working with stakeholders for some time now in developing the regulatory framework for future licensing applications on advanced reactors.

The ACRS was established by statute and is governed by the Federal Advisory Committee Act, FACA. That means that the committee can only speak through its published letter reports.

We hold meetings to gather information to support our deliberations.

Interested parties who wish to provide comments can contact our office requesting time after the meeting announcement is published in the Federal Register.

That said, we set aside ten minutes for spur of the moment comments from members of the public attending or listening to our meetings. Written comments are also welcome.

The ACRS Section of the NRC public website provides our charter, bylaws, letter reports and transcripts of all meetings, including the slides that'll be presented here.

The rules for participation in today's meeting were announced in the Federal Register on March 2, 2017. The meeting was announced as open/closed. This means that we can close the meeting to discuss sensitive issues and presenters can defer questions that should not be answered in public session.

No written statement or requests for making an oral statement to the Subcommittee has been received from the public.

Dr. Ed Lyman of the Union of Concerned Scientists was planning to provide his presentation, however, due to other commitments, he had to cancel that presentation today.

A transcript of the meeting is being kept and will be made available, as stated in the Federal Register Notice. Therefore, we request that participants in this meeting use the microphones located throughout the meeting room when addressing the Subcommittee.

Participants should first identify themselves and then speak with sufficient clarity and volume that they can be readily heard.

A bridge line established for the public to listen to the meeting, the bridge number and password were published in the agenda posted on the NRC public website.

To minimize disturbance, the public line will be kept in the listen in only mode. The public will have an opportunity to make a statement at the end of the meeting.

We have a separate bridge line for

members of the Department of Energy and the National Laboratory staffs to listen in and, if necessary, participate in our discussion. This line will be kept open, and while it's open, I ask everyone on that line to silence your phones. We're getting some clicks and pops now.

I'm requesting -- that's what it says next -- either silence your phone, mute it or press star six to do that.

Also, to avoid disturbance, I request that attendees put their electronic devices in the off or noise free mode.

By the way, we had a meeting on Advanced Reactor Design Criteria last month and tomorrow, we will have a full committee meeting on today's topic and that one.

During that meeting, one issue was raised that I hope staff will touch on today. And, that was it's a little hard to evaluate the design criteria in the absence of a set of licensing basis accidents that comes under your Strategy 3 and that connection between the two is something we'd like to hear about today.

At this time, I'm going to invite John Segala to introduce the presenters and start your

briefing.

John?

MR. SEGALA: Thank you.

Good morning, I'm John Segala. I'm the Chief of the Advanced Reactor and Policy Branch in the Office of New Reactors.

I have here with me today Amy Cubbage and Bill Reckley on the two ends. They are Senior Project Managers in my branch.

And, then, I also have Steve Bajorek who's the Senior Technical Advisor for Thermal Hydraulics in the Office of Research.

We are pleased to be here today to discuss NRC's readiness activities for reviewing and regulating advanced reactors.

As you know, over the past several years there has been a significant increase in industries interests in developing and licensing advanced reactors.

The Department of Energy released its vision and strategy document with the goal of having two or more non-light water reactors ready for construction in the early 2030 time frame.

Similarly, the Nuclear Energy Institute issued its strategic plan for advanced non-light

water reactors where they anticipate demonstrations of one or more non-light water reactors in the 2025 time frame and commercial availability of two or more non-light water reactors in the 2030-2035 time frame.

In December 2016, the think tank, Third Way, updated its report identifying 58 companies developing advanced reactor designs and other nuclear technologies.

In response to the -- oh yes -- congressional legislation has been put forth in both the House and the -- House of Representatives and the Senate for research and development and licensing of advanced reactors. Although none of these bills have passed both Houses, congressional interest remains very high.

In January, two bills passed the House and today, there's a -- the Senate is holding a hearing on S. 512 which is the Nuclear Energy Innovation and Modernization Act.

MEMBER CORRADINI: So, can I just clarify? I assume all three of the things that you've just mentioned are probably not sync, but is there a continuing conversation with the DOE side so you understand how things are changing?

MR. SEGALA: Yes.

MEMBER CORRADINI: Or what they'll be told to change and what you might be told to change?

MR. SEGALA: In terms of the bills?

MEMBER CORRADINI: Yes.

MR. SEGALA: I'm not -- I mean, we have ongoing discussions with DOE on a regular basis. I'm not sure we specifically discussed the bills, but --

MEMBER CORRADINI: Okay. No, no, I didn't expect that.

MR. SEGALA: -- as we move forward --

MEMBER CORRADINI: Just your --

MR. SEGALA: Okay.

So, in response to the growing interest in advanced reactors, the NRC developed its final vision and strategy document in December of 2016. And, this had a strategic goal of assuring NRC's readiness to effectively and efficiently review and regulate non-light water reactors.

To help achieve this goal, the NRC developed its Draft Near-Term, Mid-Term and Long-Term Implementation Action Plans.

The Near-Term Implementation Action

Plans includes six strategies. So, for the presentations today, Amy Cubbage will start off with providing an overview of our vision and strategy document and our associated implementation action plans.

Steve Bajorek will then discuss the Near-Term Implementation Action Plan Strategy 2 which involves acquiring and developing sufficient computer codes and analysis tools to perform advanced reactor reviews.

Bill Reckley will then discuss Near-Term Implementation Action Plan Strategy 3 which involves developing guidance for flexible regulatory review processes within the bounds the existing regulations, including conceptual design reviews and stage review processes.

And, then, Amy Cubbage will finish up with discussing the Near-Term Implementation Action Plan Strategy 5 which involves identifying and resolving technology inclusive policy issues.

So, since the implementation action plans will be used by NRC over the next several years to identify and prioritize our execution activities, we value and look forward to any feedback or insights that the ACRS has today.

With that, I plan to turn it over to Amy Cubbage unless anybody has any high level questions.

MEMBER CORRADINI: I have a question. So, there was a study done by the DOE called the Option Study for Test Reactors and Demonstration Reactors. Has staff looked at that?

Because, that seems to be at the core of a lot of the decision making from a time table and a what if strategy or scenarios. Have you guys looked at that?

MS. CUBBAGE: Yes, we're aware of it and we're monitoring those developments. But, until, you know, there's more concrete plans of what -- when, you know --

MEMBER CORRADINI: Okay.

MS. CUBBAGE: -- we're, you know, looking --

MEMBER CORRADINI: Okay.

MS. CUBBAGE: -- for that to be able to reactor.

MEMBER CORRADINI: So, that's fine. But, let me just get to the nub of it. In that option study, they have a time table which says that, at best, if I had a mature technology, I

can't get to a construction, would you quoted as year 2030 for 13 years, let's say, 13 years, a good number.

So, I work backwards from that, that means there's expectations of pre-application discussions now. So, my question is, since that is a referenced in the in the SIAP report, that's a referenced document in the vision and strategy document. That's a referenced document in this.

They are the only ones that did an analysis on how this all might fit together, even if it was a mature technology. And, it strikes me that something's got to be synced with what the expectation is.

They also estimated that if it was an immature technology, we won't say what that is, but I think we can take a guess, we're talking 20 years.

So, I understand the need for flexibility here, but I'm trying to figure out, coming into this, how does one think about this relative to what, at least, the DOE thought was happening?

Because I don't think it's going to be faster.

MS. CUBBAGE: Right. So, I think, conceptually, we understand that. And, that's one of the reasons we're trying to focus on technology inclusive issues early on and not really focusing too much on any particular technology at this point.

Although, we do have some folks that want to start pre-application near-term and we've already started pre-application with one designer. So, you know, we're working with them.

MEMBER CORRADINI: Well, the only reason I bring it up at this point is not that you need to respond now, but to keep it in the back of your mind because the impression I got from that study was, the schedule and costs, if mature, is technology independent and the schedule costs is technology independent that's immature.

And, they're just long time frames with a schedule that involves licensing. And, I just want to make sure staff sees that and figures it into your planning. Otherwise, I have this feeling of disconnect.

MS. CUBBAGE: It's certainly information that we would factor in into our planning.

MEMBER CORRADINI: Okay.

CHAIRMAN BLEY: Just a matter of definition when you say technology inclusive, that means things apply regardless of the technology?

MS. CUBBAGE: Regardless of the technology or within a category of technology, they would be broadly applicable to say all gas reactors or all types of sodium reactors.

CHAIRMAN BLEY: Okay, thanks.

MS. CUBBAGE: Okay, so as John mentioned, to guide our readiness efforts, we've prepared a vision and strategy document. It was published last year for informal comment and we stated in that document our strategic goal of assuring readiness to effectively and efficiently review non-LWRs by 2025 to be prepared to issue licenses in the 2030 time frame to support the DOE deployment goals.

We identified three objectives in this document, enhancing technical readiness, optimizing regulatory readiness and optimizing communications.

There was a recurring theme in the stakeholder feedback we got that the time lines were too long which is contrary to what Dr. Corradini just said. So, we're kind of balancing,

we're getting feedback and inputs from different avenues that are saying go faster or we're about right or go slower. So, we're balancing those needs.

MEMBER CORRADINI: If I might, since you're right, for sure, but reality is still reality. So, I think staff has bot to be cognizant of what some of the advocates are saying, but, from a realistic standpoint.

That's why I point to this document because it's been vetted by the DOE, by the CF, by NEAC and, in all cases, those two conclusions I mentioned about mature and immature and timing, seem to stand up as a realistic.

So, I'm not looking at -- to optimistic, I'm looking to realistic.

MS. CUBBAGE: Okay, that's good feedback.

So, what we did with the document to address the feedback is that we acknowledged that, you know, if we have a specific pre-applicant that comes in, we're going to work with them on their needs on whatever policy or regulatory decisions are needed to support their business plans.

And, we published the revised vision

strategy in December.

MEMBER KIRCHNER: Amy, may I interrupt?

MS. CUBBAGE: Yes.

MEMBER KIRCHNER: And, just ask, for the record, what do you have in front of you in terms of firm, not applications, but designs that you are putting in your queue or anticipate that you're going to be reviewing in the nearer term?

MS. CUBBAGE: So, we've begun -- I have a slide on this later, but I can give you a preview.

MEMBER KIRCHNER: No, we can wait.

MS. CUBBAGE: Okay, all right.

MEMBER REMPE: Actually, talking about reality, there's all these bills that have been proposed. And, although our mission is safety, just for the record, did you ever get any of this -- some of those bills talk about having things that are off the fee base spending for NRC. Has NRC gotten any of the fee base directly from Congress that were appropriated? Or where is that if any --

MS. CUBBAGE: Okay.

MEMBER REMPE: -- is forecast to be charged --

MS. CUBBAGE: Right.

MEMBER REMPE: -- short-term?

MS. CUBBAGE: So, for FY17, the budget does include all fee based funds. But, given that we're in a Continuing Resolution, we haven't physically received any authorization for off fee base spending. So, we're using our existing on fee base resources at the moment to support this activity and a budget request in future years will also include off the fee base money in conjunction with our congressional oversight.

MEMBER REMPE: Thank you.

MEMBER SKILLMAN: Amy, let me ask this question.

MS. CUBBAGE: Sure.

MEMBER SKILLMAN: Most of the technologies that come to maturity, there's either a burning platform or someone who says I'll do it. I'll just do it.

Is there either a burning platform -- you've mentioned the time spans 13 years, 20 years, that type of thing. That sounds like an awfully long time, if there is an applicant that says I'm ready to do this. I'm really ready to do it no matter what the future brings.

Is there someone who is in that

position?

MS. CUBBAGE: There are applicants who want to come early with applications.

MEMBER SKILLMAN: Must their entry await all of the other administrative issues that you will be talking about?

MS. CUBBAGE: No, we could receive an application. We could review it. It may take longer and it may not be as efficient as if we had put in place, you know, all of the infrastructure that we need.

But, you know, I was the project manager for the PBMR review in 2001. We were ready to receive an application in 2002 for the PBMR and then that project was cancelled.

Bill was involved with NGNP. We were ready to review the NGNP project had that not been suspended by DOE.

So, there is no impediment to someone coming and submitting an application.

MEMBER SKILLMAN: Right now?

Okay, one final question. Is there one specific requirement, design requirement that would trump all of the others from the perspective of no matter what the design is, whether it's a gas

reactor, a sodium reactor, a salt reactor, a lead-gold reactor, if it fits in that requirement no matter what, it's good to go?

For instance, a very strong containment, just a strong box.

MS. CUBBAGE: So, I think of it in a different term. I think of it as the ultimate dose to the public and that could be justified by either the inherent characteristics of that design or the existence of a containment or the inherent characteristics of that fuel barrier.

So, there are many different layers that could be weighted. So, I wouldn't necessarily say we're in a place to say everything could be -- has to be solved by a containment. But, certainly, if someone were to voluntarily want to use containment as their barrier to show that the dose to the public was acceptable, that would be an option.

MEMBER SKILLMAN: Well, I'm just wondering if there is an opportunity, instead of getting into a quantitative discussion about probability of failure of the containment or probability of failure of the fuel or probability of failure of this, that and the other, one simply

said qualitatively, we don't care.

MS. CUBBAGE: Right.

MEMBER SKILLMAN: Here's the box. If you make the box this strong --

MS. CUBBAGE: So, from a --

MEMBER SKILLMAN: -- no matter where you put this machine --

MS. CUBBAGE: Yes.

MEMBER SKILLMAN: -- the public's protected.

MS. CUBBAGE: From a defense-in-depth perspective, I think we'd be reluctant to put all of our eggs in the containment basket. Because, if you have a scenario that truly leads you to a severe accident, it could challenge the containment.

So, I think --

MEMBER SKILLMAN: But, okay, hold on. But, wouldn't you make it then a stronger containment?

MS. CUBBAGE: I think your colleague to your right could always figure out a way to fail that containment.

MEMBER SKILLMAN: Oh, I'm sure he could.

(Laughter.)

MEMBER SKILLMAN: I mean, he's going to disburse gas and blow it up and put so much C4 in there --

MS. CUBBAGE: Right, right, right.

MEMBER SKILLMAN: -- it's gone.

But, realistically, though, what I'm really saying is, if there were to be a drive to get going now, is there, if you will, an overarching requirement that could be establish that says, no matter what, if you do this, we can move ahead now, even with the risks that we're concerned about?

MS. CUBBAGE: Well, I'll answer your question in two ways.

One would be that the business model for some of these applicants, particularly for a small reactor to have such a containment structure, would be potentially cost prohibitive because that's an area where they're trying to simplify the design and minimize costs.

And, then, on the other hand, I would say the prototype provisions that we can get into in a little more specifics, but, if you have a design that has uncertainties and the first of the

kind could be licensed as a prototype which would mean it would come in as a regular either construction permit or combined license. But, there could be additional safety features such as a leak-tight containment or a robust containment or remote siting or additional EP that could balance the uncertainties in the design.

So, those are kind of two ways I would answer that question. But, at this point, it wouldn't be for us to dictate to any applicant that they should propose to put all of their eggs in the containment basket.

If someone were to propose that, we could certainly look at it.

MEMBER SKILLMAN: Thank you. Thanks.

MS. CUBBAGE: Okay. So, moving on, from that structure of the vision strategy, we have implementation action plans. We have divided them into the near-term, what we're going to work on the zero to five years, mid-term and long-term, getting out into the out years.

You'll see a lot more specifics in the zero to five. By definition, it's a little more difficult to plan what we're going to be doing in five to ten years until we see what we've achieved

in the first five years and also what applicants have come to fruition, et cetera.

CHAIRMAN BLEY: At the risk of putting the cart before the horse here --

MS. CUBBAGE: Yes?

CHAIRMAN BLEY: -- we're now looking at the Near-Term Implementation Action Plan Report?

MS. CUBBAGE: Yes.

CHAIRMAN BLEY: Okay.

MS. CUBBAGE: And, you should have the mid and long as well.

CHAIRMAN BLEY: We have copies of those. What's your -- and you want a letter on the near-term?

MS. CUBBAGE: Yes.

CHAIRMAN BLEY: Tomorrow.

Is that about to be issued final or what's your thoughts?

MS. CUBBAGE: So, what we're going to do with the near-term and mid and long as a group is, we're going to take your feedback, we're going to take feedback from stakeholders. We've got a letter just this week from NEI, or was it Friday, well, anyway, in the last few days a letter came in from NEI.

We're going to take a look all of that and then we're going to bundle it up and send it to the Commission later this spring.

CHAIRMAN BLEY: Okay.

MS. CUBBAGE: So, the mid and long are pretty high level. I'm going to get into those in a little bit. So, I don't think you should focus too much attention on that. I think the near-term is really where the meat bulk of the information is at this time.

CHAIRMAN BLEY: Okay, thanks.

MS. CUBBAGE: So, just to explain what the IAPs are, we needed to have a way to set forth what we're going to work on to get to reach our goals and to help us plan our resources and develop a budget and develop a workforce.

So, that's what the IAPs do. The non-public versions have detailed resource estimates for the first five years. Those are estimates. When we get into execution for each year, we develop detailed budget models and we figure out exactly what we're going to be working on in each year.

So, I would view the IAPs as more of a guideline of the things we're going to be working

on and about when we'd be working on them. But, then, we inform our actual work based on the budget we have in hand, the people we have in hand with the right skills and then we prioritize our work accordingly.

MEMBER REMPE: I've got a high level question. I was looking at the documentation. The picture you showed on slide four included the lead-cooled fast reactor. But, the documents don't have as much detail on the lead fast-cooled reactors.

MS. CUBBAGE: Right.

MEMBER REMPE: Is there a reason for that?

MS. CUBBAGE: So, the near-term applicants that are approaching us are not in the lead-cooled arena. However, we did get some feedback from the labs and from DOE that we should factor that in.

So, I think we're going to probably more broadly characterize liquid metal reactors in the revision rather than being as specific just to encompass that.

MEMBER REMPE: Thank you.

MS. CUBBAGE: But, we're just getting that feedback and haven't had a chance to react to

it in the documents yet.

CHAIRMAN BLEY: As you do that, are you expecting things to change or is that just you think everything fits under that umbrella --

MS. CUBBAGE: I think that would already --

CHAIRMAN BLEY: -- from what you already did?

MS. CUBBAGE: -- be an umbrella, but I'm going to look to Steve when he gets into his presentation.

CHAIRMAN BLEY: And, I broaden that to include the design criteria.

MS. CUBBAGE: Well, we have the other on the design criteria. So, I don't know whether this would fit in the other or the sodium fast or how that would play out.

CHAIRMAN BLEY: So, you haven't worked that out yet?

MS. CUBBAGE: We haven't worked that out yet, or at least I haven't. Jan, do you know? Okay.

Okay, so, moving down to the near-term IAPs, we put them out for public comment. We've had three public meetings. We're getting some

written feedback and we plan to issue them later this spring.

They were developed independent of funding availability. We wanted to get a full picture of everything that would be needed to get ready and then our actual resource funding levels will impact the pace of execution.

There are six strategies, as you've seen, in the near-term IAPs. We're going to focus on a few of them today. I'll just give a brief overview of all of them.

The first one, developing sufficient knowledge, skills and capacity to form non-LWR reviews. That's things like training. We're contracted right now with Oak Ridge on a molten salt reactor training class. We're going to be offering that to staff this summer.

We're doing things like workforce competency modeling, knowledge management. There's decades of information out there on these designs. We have a lot of it, it's in different places within the agencies. We're going to try to get that all into one place and organize so the staff can access it better and use it as a resource and, ultimately, hiring, if needed, et cetera.

MEMBER SKILLMAN: Amy, for that Strategy 1, you picked the molten salt reactor. To what extent will the work that is done for that design be applicable to the other designs?

MS. CUBBAGE: So, we picked the molten salt training at this time because that's the area where we have the least knowledge. We have good familiarity with the gas-cooled reactor designs going back to PBMR, NGNP, et cetera.

That technology's more mature. There have been training courses already developed. We have those recorded. We have access to those.

So, we felt that there was a need to develop training on molten salt was a priority. So, that's just why that was a near-term one.

MEMBER SKILLMAN: Thank you. Okay, thanks.

MS. CUBBAGE: And, also, the Canadians were working on a molten salt design and they wanted to partner on development of training. So, that kind of led us in that direction.

MEMBER SKILLMAN: Thank you.

MS. CUBBAGE: Okay, Strategy 2, Steve's going to get into a lot more detail on that, so I won't focus on that, but, other than to say that,

you know, we've been focusing on the title as computer codes and tools. But, it also is broader than that.

There's some materials research aspects in that area.

Strategy 3, Bill is going to get into that a lot more.

You've also been hearing about things like the ARDCs in the recent meeting. That's part of Strategy 3.

Strategy 4 is industry consensus codes and standards needed to support non-LWRs. We are in a role of we participate in standards committees. We ultimately endorse by Reg Guide or rule if there's a standard that develops to that point and is going to be broadly applicable.

But, at this point, we're looking to industry, DOE, NEI, the individual working groups, molten salt, gas reactor, et cetera, to identify what codes and standards are needed and to get started on that development. It's a long lead area.

And, then, we will monitor that and we will participate in code committees as appropriate.

One specific area we're spending on

some significant time on right now is the ASME Section III, Division 5 standard for high temperature materials.

We have people that are on that code committee and so we're actively involved with that.

MEMBER CORRADINI: So, if I might?

MS. CUBBAGE: Please.

MEMBER CORRADINI: I'm sorry, but I'm still back with Strategy 1.

MS. CUBBAGE: Okay.

MEMBER CORRADINI: You're very efficient.

MS. CUBBAGE: Go ahead.

MEMBER CORRADINI: So, you asked -- Dick asked the question, I guess he's thinking as I, about why MSR. And, your answer was it's different enough that there's some need.

Does the staff already have appropriate skill sets for the other two or is the staff training other new or younger staff about sodium fast and gas?

MS. CUBBAGE: I would say at this moment, we do not have a full complement of people that are trained, but we have existing training available on gas reactors.

MEMBER CORRADINI: So, subject matter experts or the actual training guides? That's what I was trying to ask.

MS. CUBBAGE: We have some staff that are --

MEMBER CORRADINI: Okay.

MS. CUBBAGE: -- familiar.

MEMBER CORRADINI: Okay.

MS. CUBBAGE: And, then we also have training courses that have already been developed.

MEMBER CORRADINI: Okay.

MS. CUBBAGE: So, we don't need to go off and develop training course. They are ready on the shelf.

MEMBER CORRADINI: Okay. And, maybe it's somewhere, and I should have asked this earlier, but I didn't see where -- are all of these being done in parallel at the same -- is the expectation that all of these would be done in parallel at the same rate or does something take precedent over something else?

For example, to me, Strategy 3 seems to loom over everything else relative, and 5, relative to policy issues and what our Chairman mentioned in terms of licensing basis events.

And, before I start training and planning and writing computer programs --

MS. CUBBAGE: Right.

MEMBER CORRADINI: -- I might want to see, you know. So, is there a prioritization on how these fit?

MS. CUBBAGE: There's a definite prioritization within the individual strategies --

MEMBER CORRADINI: Now, that I saw.

MS. CUBBAGE: -- of what to work on. We are working on some things across the board, every strategy. But, I totally appreciate what you're saying and that we're heavily weighting Strategies 3 and 5 early on. But, you know, Strategy 4, we, you know, we need to participate in ASME if the code committee now, now is the time to participate.

As Steve's going to get into on the computer codes, the first year here, we're more exploring what's out there.

MEMBER CORRADINI: Okay.

MS. CUBBAGE: You know?

MEMBER REMPE: So, I think we got you off topic. Though, on that same line, when I was looking at the non-public Volume 2, I lost track,

but it sure seemed like, and again, I know our main bailiwick is safety, but Member Powers often tells us that if we waste a lot of money on some things, safety could be adversely affected. But, it sure looked like Strategy 2 was the most expensive strategy.

MS. CUBBAGE: Right.

MEMBER REMPE: And, it was starting early on. And, is that correct? I mean, maybe even an order of magnitude more than some of these other strategies, is that --

MS. CUBBAGE: There's definitely a -- Strategy 2 is expensive work.

MEMBER REMPE: You bet.

MS. CUBBAGE: Yes. So, it's the nature of the work, not necessarily that we're giving it higher priority.

So, we can get a lot accomplished in Strategy 3 and 5 within the house, project management, resources.

Strategy 2, if you get into developing new codes, I mean, that's expensive work. So, that's --

MEMBER REMPE: And, I'm mindful that we spent -- the NRC spent resources to modify MELCOR

for a gas reactor that -- models that may not be used for quite a while here. You know, depending on what comes in first.

And, so, I just, I mean, I was looking at this, I'm going, man, it's a lot of money when we aren't sure what, if anything's, coming in.

MS. CUBBAGE: Yes, so do you want to wait until you get to your presentation? But, he's going to get into it, you know, but we're going to --

MR. BAJOREK: Since the question was asked, yes, Strategy 2 is one of the areas where you tend to be less generic.

I mean, a molten salt is so much different than a sodium fast which is so much different that a gas-cooled reactor. The codes, the analysis, the needs for each of those are almost individual where most of the other strategies can look at things in a more generic basis.

And, because of that, that drives up the costs in Strategy 2.

MEMBER REMPE: Yes, everything's times three.

MR. BAJOREK: We would hope that,

eventually, as the number of applicants define themselves better and we know which design type has the priority, we'll be able to refine that better.

But, right now, when we're being asked to look at all, I think somebody said there's 52 types of designs out there, it's very difficult for us to hone in on one or the other. And, as a result, our costs are a bit higher.

MEMBER REMPE: We'll talk about this more, but when I was looking at it, I was wondering, jeepers, can't you just use their codes until they really come in with something and then let them pay to do your independent code development? But, that's just, when I was looking at this, I was going, that's a lot of money for something that --

MR. BAJOREK: We have a -- we'll be getting to that.

MS. CUBBAGE: Yes, we'll get into that. I mean, we want to leverage existing codes to the maximum extent possible.

CHAIRMAN BLEY: I'd also caution, I mean, it's easy to see where all the detail has been laid out in Strategy 2 and all of the different technical areas.

Strategy 3 is going to take a lot of work to get that right. And, more -- it isn't as easy to see the depth of how much work is there to get that right. I mean, it could be a lot harder than we think.

MEMBER CORRADINI: I'm waiting -- I expect that Dennis has this, but, I guess my point is, I'm kind of with Dennis is that, although on paper, 3 looks easier, when we went through NGNP, this is where we hit a roadblock as to what is a licensing basis event? Which ones fit into a design basis? Which fit outside of the design basis? What is the likelihood of frequency? What is the measure of dose? And, those sort of things.

And, then, Strategy 5 relative to -- from a policy standpoint, what is a containment functional performance criteria? What are the source terms that one has to --

I mean, to me, they look easy, but they're hard. Whereas, in 2, I might get along with, excuse my English, hand calculations of things that are 25 years old until I really see I need something.

MS. CUBBAGE: Right, right. And, I didn't mean to imply that any of the strategies are

easy. But, just that, you know, you end up with a lot of contract costs if we end up having to develop codes and that's why the --

And, then, Steve said, you know, you kind of got to do it for each technology, so it ends up at least tripling. But, he could take more questions on that later.

Strategy 4, another thing I wanted to mention is there's a non-LWR PRA standard that we're looking at. And, there are also ANS standards.

Strategy 5, policy issues, I'm going to get into later.

And, then, lastly, Strategy 6 has our communication strategy.

Okay, so this slide has some examples of the ongoing work. Some of these I've already mentioned.

We are making significant progress in a lot of these areas. We're going to get into more detail on several of these later. If there are any that catch your eye, I can take questions on them.

I think I've mentioned many of these things already.

MEMBER KIRCHNER: There is one, Amy,

that I'd like to ask. It's probably a combination of number three and five.

And, that is, how high are you going to set the bar coming in? There's been a lot of talk of reviewing conceptual designs. At what quality level, I'm assuming Appendix B, would be behind the designs that you're reviewing?

So, we heard a lot about at our last Subcommittee meeting about design criteria. There wasn't much mentioned of quality in the design. So, what is your thinking now in terms of, quote, unquote, a flexible review process and a quality of what you're going to review?

MS. CUBBAGE: So, Appendix B would apply to designs that ultimately are going to be licensed. I don't know if Bill, if you want to say any more about that with relative to the conceptual design?

MR. RECKLEY: What we'll see or what we expect to see is a gradual approach. So, when you're doing the pre-application work, they won't -- they may not even have an Appendix B program at that point. But, they still may have questions in terms of what their regulatory approach for that design may be.

So, at that point, we'll be giving preliminary feedback. As they move closer to actually making an application then things like Appendix B would kick in.

But, what we'll talk about later is one of the things that is different this time, at least from my perspective, is an emphasis on us engaging early in the process and kind of parallel to the business model and the funding stream such that things are moving along together.

They may have, for example, a particular designer may have a question that, I'll just pick an example, would this kind of an approach to reactivity control work? Because we're still in the conceptual design phase but that might be critical to deciding ultimately how much the machine is going to cost.

And, so, they want an early indication as to whether this approach would pass regulatory muster and we are trying to, under this flexible and staged approach, set up so that we can answer that question even though the applicant may be, at that point, one of these firms with a dozen people.

And, as they get those answers questioned, they're able to progress on the design

and, ultimately, they'll come in later with an actual application.

So, when we talk about staged or -- and a conceptual design, that's one aspect that's a little different that we're not dealing with the big companies this time and we're going to be doing things in parallel with their funding stream.

MEMBER CORRADINI: So, can I say, back to -- this is the one that I didn't understand. So, you call it conceptual design approval or conceptual design review, is that -- what --

There are figures out there that ascribes to the process. I'm trying to understand what you just described, what is it?

MR. RECKLEY: I would call it an assessment. We're trying to get away from a word of approval because that's used later, for example, under standard design approval as a formal regulatory decision.

What we would be giving in that particular instance is feedback that may be just the staff saying, hey, just based on what you said, we think it'll be okay.

The applicant may submit something like a topical report, which, again, that'll give a more

formal answer. It could include a CRS. You have the option of weighing in on the topical.

MEMBER CORRADINI: Thank you.

MR. RECKLEY: If they're doing a topical, that would -- that may very well bring in then Appendix B.

So, all of those things we can handle, but each interaction would determine how we approach it and how much it'll cost the designer for that regulatory feedback.

(Simultaneous speaking.)

MEMBER KIRCHNER: I had a follow up. Then, Steve, where I'm going with this, rhetorically, there are 58 people out there doing different designs or whatever.

As you think through your flexible review process, what bar would there be of entry? I mean, are you just going to review all 58 or and disburse your resources accordingly? Or in reality you're not going to get 58 submittals.

MR. RECKLEY: Well, and a lot of those 58 are just -- I shouldn't say just -- but they're --

MR. KIRCHNER: I shouldn't say just, but they're, of course --

MR. RECKLEY: Right, and the small companies, some of them are university programs that I'm sure they would ever come to us through that design.

Go back to the -- go back to reality, we charge $250 an hour, so that becomes an actual real discriminator.

MS. REMPE: But, we often --

CHAIRMAN BLEY: I had a couple of questions. Oh, I'm sorry, go ahead, Joy.

MEMBER REMPE: We often hear about the Canadians and their vendor design review, right? And, if we look at the view graphs they presented at some meeting back in Oak Ridge, I think last fall, they focus on the vendor's integrated management system processes used to develop a high quality design configuration.

And, the outcome of their review reflects the quality of this vendor design process.

And, are you -- have you talked to them? It sounds to me like they have bar for the quality of the design that's being developed.

And, the reason why I'm talking about this is, have you seen an article that was in Technology Review about the Transatomic design and

some major --

MR. RECKLEY: Yes.

MEMBER REMPE: -- errors in their calculations. And, so, that's why I'm --

MR. RECKLEY: Yes, yes and yes. We've talked to the Canadians. We're well aware of that article.

MS. CUBBAGE: Yes, so keep in mind, what we're talking about is a flexible approach where if you want feedback based on the information you give us, this is what you get. If you want an approval, then there's clear requirements.

You know, so, it's a graded approach, the feedback you want, the information you provide us. You also have to keep in mind, the Canadian approach doesn't have a Part 52-like approach. So, they don't get an approval -- they don't get a design certification.

So, if they want a level of certainty before they go into a licensing application, their product is a different type of product than what Bill's talking about here.

MEMBER KIRCHNER: Amy, then you bring up an interesting consideration then. I can see how an applicant would want an NRC certification

for all kinds of good business reasons.

But the 52 process, if you really look at it, was for evolutionary reactors, not for out of the box, one of a kind first off prototypes.

And, I don't want to compare the Canadian approach, but, basically, it's 10 CFR 50 after you go through this first hoop.

So, what is your thinking here? I mean, for a one of a kind design that's not even then built, 52 is a big reach. I mean, they could go for it.

MS. CUBBAGE: They could do 50 or 52. But, I think what Bill was trying to say is that, you know, you could come in with topical reports, you could -- you know, it depends what they come in with and then the quality would have to match.

MEMBER KIRCHNER: But, would it help you and also help the industry to have some expectation for that conceptual design review or whatever you're thinking is, or are you thinking you'll just take topical reports?

MR. RECKLEY: Well, I'm going to talk about it later this morning.

MEMBER KIRCHNER: Okay, all right. I'll wait.

MS. CUBBAGE: But, I think my overall philosophy is that we have a range of vendors with a range of financing, with a range of business plans, with a range of feedback they need at different stages. So, the flexibility, I think, is helpful to this community. But, you know, if there's an overriding desire for one-size-all approach, we can do that, too.

MR. RECKLEY: And, one of the things I'll mention now and then we'll get into more detail later is, we're asking each of the designers to develop and work with us on a licensing project plan that is for them.

So, we're not sitting here looking at multiple designers and not knowing what's coming in the door from whom. We will have licensing project plans for the designers and those will say, that designer's planning to come in with a topical report. That one just wants meetings to get feedback. This other one may want something else. So, we'll know what's coming in and we can plan accordingly.

MEMBER CORRADINI: Where was that? That sounds very reasonable and rational. Where is that in the IAP? Did I miss that?

MR. RECKLEY: I'll get to it. It's under Strategy 3, Item --

MEMBER CORRADINI: Okay, fine.

MR. RECKLEY: -- in one of the contributing activities.

MS. CUBBAGE: In the draft licensing roadmap.

MEMBER CORRADINI: Okay.

CHAIRMAN BLEY: Two things I want to do at this point, Dr. Margaret Chu joined the Committee a little while ago. I want to have that on the record that she's here.

One thing that's confused me a bit, and Bill's statement might take care of, but throughout the document, you talk about conceptual design and different stages. I'm pretty familiar with what DOE does with their conceptual design, preliminary design and so on. I've seen what the Army does. I've seen other organizations.

You don't really define what you mean by those terms anywhere. So, it seems to me you ought to.

MS. CUBBAGE: Well, there's preliminary design information that would be the level to support a construction permit. And, then, final

design information level to support a combined license or a design certification or an OL.

And, then, conceptual design information, it could run the gamut.

CHAIRMAN BLEY: So, you think of three levels of design?

MR. RECKLEY: Actually, when you look at the roadmap, what we're proposing to use is the DOE's critical decision model.

CHAIRMAN BLEY: Okay. But, then, I hope you use their definitions or your own but so that it's clear.

MR. RECKLEY: Right.

CHAIRMAN BLEY: Because that makes sense, but I didn't read that as I read through it.

MS. CUBBAGE: Well, I just wanted to be clear that the preliminary word as a regulatory implication relative to a construction permit.

CHAIRMAN BLEY: Okay, but does it say that in the document somewhere?

MR. RECKLEY: We try to align them. They don't work perfectly because we have words in our regulations and the DOE orders are using similar words for slightly different purposes.

But, in general, they align pretty

well. I mean, you're basically talking --

CHAIRMAN BLEY: As long as you're individually with each one laying out a plan, that makes sense. But, if I come in and read this and decide I know what this stuff means, I might get really surprised.

MR. RECKLEY: Right.

CHAIRMAN BLEY: That's all I'm saying.

MS. CUBBAGE: Okay. Mid-term, I forget where I am.

Okay, mid-term, generally, I know you've just recently received it, but if you've had a chance to look at it, the strategies in the mid-term follow similar to the strategies in the near-term. They're a continuation in some cases of work.

They're an evolution in some cases, for example, the policy issues start to shift towards technology specific in the mid-term rather than the near-term which is technology inclusive.

We're shifting in some areas to developing guidance to starting to put it out in Reg Guides, into rulemakings if we need to.

The main shift in the mid-term is where you see Strategy 3 where we're looking at branching

beyond the existing regulatory framework and developing a new one if needed. So, we'd be starting that effort in the near-term and then, that follows into the --

MEMBER POWERS: Amy, let me ask you a question --

MS. CUBBAGE: -- in the mid-term. I'm sorry.

MEMBER POWERS: The framework that, you know, a lot of gets presented to us for these advance design persists and anguishing over the design basis accidents.

And, in my exploration of that, I have come to my own personal conclusion that the design basis concept was really introduced to make life easy for designers. But it really, that in Agency that professes to limit the risk to the public health and safety that design basis accidents don't really help at all, that most of the risk is associated with accidents that go beyond the design basis.

Is it, in thinking about a new regulatory strategy for these new designs, is consideration being given to the idea that the Agency should abandon the idea of design basis

accidents and focus, instead, on the limitations of the risk?

MS. CUBBAGE: Let me think about that.

MR. RECKLEY: I mean, we have thought about that kind of an approach when we've been working with stakeholders, even back to NGNP and earlier. That was not the approach that the stakeholders chose.

And so --

MEMBER POWERS: I couldn't -- I have no control over stakeholders, well, any more than you do.

MR. RECKLEY: But, as we develop the approach, we're not working in isolation, we're working with the designers through NEI, DOE in the case of NGNP to construct this.

The logic in keeping a lot of that old structure was because the programs like Appendix B and working with the vendors and safety classification of equipment broader, was all set out so you could build on that infrastructure. That was part of the logic, right or wrong.

MEMBER POWERS: You're talking about the past.

MR. RECKLEY: Right.

MEMBER POWERS: And, I'm explicitly addressing the future.

MR. RECKLEY: Right.

MEMBER POWERS: It seems to me that that is a variety of baggage that is not helping the progression of the regulatory structure to attack designs that deviate markedly from what you've licensed for the last 40 years.

MR. RECKLEY: And, I'll agree with you to some degree. It's baggage and, to some degree, it helps because it's existing infrastructure. So, there is good and bad in doing that.

We'll look at the designers to basically ask us if we would entertain something. But, we don't see ourselves, at this point, in the plans developing something for ourselves.

MEMBER POWERS: I don't object at all to the designers using a design basis accident. They can use anything they want to. At nowhere that I can find in the Atomic Energy Act does it say thou shalt have a design basis accident. Instead, it says, thou shalt provide adequate protection of the public health and safety.

And, we know now that design basis accidents don't always help in finding what the

threat to the public health and safety is. I think assuredly TMI demonstrated that for us pretty clearly.

And, we have an alternative mechanism now and an alternative policy that seems to lay out a pathway to assess these things. Let the designer do a design basis accident and then assess the risk to his design as his plan of health and safety.

MR. RECKLEY: And, most of the approaches that we're seeing in the NGNP and the most recent does actually look at a combination of those. They continue to use design basis accidents for certain purposes, but they do go broader and use PRAs to look and incorporate into the licensing basis not only the design basis accident, but a broader set of licensing basis events. And, we'll talk about that a little later in the morning.

MEMBER CORRADINI: So, I guess Dennis reminded me what you just said, I forgot. But, to get to Dana's point, well maybe staff did, but we never saw the end game of closing a loop on that activity.

Because it seems to me the HTG, the NGNP, whatever it is, activity was a path forward that looked like a successful path forward. But,

would that not be an appropriate starting point for all of this in the mid-term so that --

Because it is a different approach, more of a composite approach.

MR. RECKLEY: Right.

MEMBER CORRADINI: And, would -- and considers things, what one might say, beyond design basis.

MR. RECKLEY: And, then, I think what you'll see both from me later in the morning and then also from the industry discussions is that is actually what's happening is we're picking up where NGNP left off.

MS. CUBBAGE: And, to be clear, we're doing that in the near-term and it would be implemented in the near-term under the existing regulations. Then, this activity in the mid and long is looking at, do you need a new part in the regulations, which remains to be seen.

MEMBER CORRADINI: Okay, okay. But, the only reason I bring this one up, since Dennis reminded, is the ACRS letter of some year, I can't remember, asked the question that seems the loop needs to be closed and here's specifically how to close the loop. And, it seems that's where I might

pick up just to be efficient.

MS. CUBBAGE: Yes, yes.

MEMBER CORRADINI: Okay.

MS. CUBBAGE: The other thing I wanted to point out on the mid-terms is that that's where we're starting to work on fuel cycle issues. But, we've been getting stakeholder feedback from NEI and NIC and others that they want us to look at fuel cycle issues sooner rather than later. So, we're engaging with them.

At this point, we don't see any particular impediments in the regulatory structure to licensing enrichment facilities, fuel fabrication facilities or transportation containers to greater than five percent enrichment.

Some of the vendors are looking at getting up right at the threshold of just below 20 percent. And, so, we're going to look at that to make sure that there's no regulatory infrastructure that needs to be put in place to support that long lead effort.

And, then, for the long-term, the only item that remains at that point is conducting rulemaking to put in place a new part in the regulations for a framework, if needed.

Okay, so, Strategy 6 is our communications and outreach. I just wanted to highlight a few examples.

We're going to have our third DOE/NRC sponsored advanced reactor workshop next month, April 25th, 26th at the Marriott across the street.

We're holding stakeholder meetings about every six weeks. Our next meeting's March 22nd.

We're working on a series of topics at those meetings including licensing basis event selection.

We have an MOU with DOE on the game initiative gateway for accelerated innovation in nuclear. That's primarily a DOE program, but under that MOU, if there are regulatory questions, we would provide information to DOE that then they could share with potential applicants.

And, then, internationally, we're actively involved with international groups. I chair the group on the safety of advanced reactors or GSAR, that's under the auspices of NEA.

And, I am going to be attending the gift policy group meeting in Paris next month, so we're plugged in on what's going on there.

And, we had a question earlier about pre-application activities.

What I can share with you is that we have started pre-application interactions with Oklo. We've had two meetings. We're going to be doing more interactions with them this fiscal year.

Terrestrial Energy has a publically available response to our RIS, Regulatory Issue Summary.

CHAIRMAN BLEY: Amy?

MS. CUBBAGE: Yes?

CHAIRMAN BLEY: Oklo doesn't click with me. Who is that?

MS. CUBBAGE: Oklo is a small sodium fast reactor in the single digit megawatts. They're a small company and they're working with us on their design.

CHAIRMAN BLEY: Okay.

MS. CUBBAGE: They don't have a lot of information on the Internet, but they're working on that design.

Terrestrial Energy, they submitted a RIS response to us. A RIS is a Regulatory Issue Summary where we go out and we ask anybody who's interesting in engaging with the NRC or plans to

submit an application to tell us and then we can plan and budget for their application.

Terrestrial did come in with a RIS response saying they want to submit either a design cert or a CP in 2019 for their 400 megawatt integral molten salt reactor. So, we'll be starting pre-applications with them soon to get ready for that.

MEMBER POWERS: Amy, let me ask you a question about these communication efforts where you're trying to figure out what to do with something you've never done before.

MS. CUBBAGE: Right.

MEMBER POWERS: And, you have commented a couple of times, we send these things out and anybody that wants to make a comment is free to make a comment.

Yet, all of your meetings and communications seem to be within a fairly closed community, applicants, DOE, things like that.

Why is it that the NRC studiously avoids presenting this kind of material at a broad forum such as the American Nuclear Society, the Health Physics Society, the ASME, consistently refuses to do that, why is that?

MS. CUBBAGE: I wouldn't know that it was -- we refuse but we --

MEMBER POWERS: We don't --

MS. CUBBAGE: -- do. So, we're going out to a lot of conferences. We're presenting this type of information to conferences.

We had, for example, we had a number of the standards committees in for a standards forum back in September and I presented information on what we're doing and we were encouraging the standards groups to get engaged.

We have people who are on working groups of the various standards committees.

Are you more focused on the standards committees or just more globally?

MEMBER POWERS: With all due deference to many of my colleagues who have a faith and standards that I don't share, I think standards are about the most boring place and the repository of people with straightjacketed thinking, by definition.

I think you need to be out soliciting to people who think about things that you haven't thought about.

MS. CUBBAGE: That's why we're here.

MEMBER POWERS: And, I think you don't. I think you religiously avoid going to people who might raise a question.

MR. BAJOREK: Amy, part of the problem, too, with going to the conferences is you're going to have to present some of the design information. And, much of this, we have to hold proprietary. And, I don't even think the list you gave there is really the complete responses because --

MS. CUBBAGE: It's not because that's --

MR. BAJOREK: -- because we've had to --

MEMBER POWERS: I am sure, Steve, that you can find an excuse not to go where anything that I might raise.

MEMBER CORRADINI: Dr. Powers is being controversial, but I do think his point is that you want to -- if you're doing communication plan, communicating with the usual suspects is not communication. That's what I think he just said.

MS. CUBBAGE: Right. So --

MEMBER CORRADINI: So, you've got to --

MS. CUBBAGE: The sort of documents we put out, you know, if they're going out more

formal, we do the Federal Register. I don't know who reads the Federal Register, but that's what we do.

MEMBER CORRADINI: I mean, just -- but I --

MS. CUBBAGE: And, then, we have a gov delivery system where I've sent out all these documents to about 1,500 different stakeholders.

MEMBER POWERS: You can't even get me to look at those things. How are you going to motivate somebody who is marginally associated with this but may have good ideas on physics.

One of your problems, and it'll come up in spades when Steve talks, is that people are designing computer codes with an incomplete knowledge of the physics that's present in these things.

And, so, when you -- when he has to go through and say, gee, I need to look and see if this code is adequate for the regulatory process. He has to ask, is it on firm technical foundation.

Well, Steve is a brilliant guy and I hang on everything he says. But, I bet you Steve is perfectly willing to admit that he doesn't know everything. He may know 99 percent of it, but that

1 percent might be crucial and the way to find that out is to put more eyeballs on the problem.

And, the learned societies provide you millions of dollars of free consulting.

MEMBER KIRCHNER: If I may follow on to Dr. Powers, it does beg a question, I mean, in the final analysis, you license reactors in the court of public opinion. That's not accurate, but something like that.

So, I think Dana's point is a very good one, having looked at a lot of black box reactor designs on paper that everything's proprietary so there's really no insight into what physics are being used, et cetera, et cetera.

And, that's gone on for a long time with a lot of these, let me call them, paper reactor designs. But now you have some serious contenders.

At what point and how much of the design is then available for public review and, as Dana points out, that broader opinion from the societies, whether it's ASME or ANS and others, is that a very useful way to have the designs also reviewed in a more public matter.

So, if you had, for example, a

conceptual design that you reviewed, at what point is that available for the concerned public to also participate in the review and to what detail will they have access to the design?

MS. CUBBAGE: So, proprietary information, in general, would be withheld from the public, but there are mechanism where interested stakeholders can get access and have nondisclosure agreements and then that gets put in place for things like security or when someone has a particular basis to question an aspect of the design, they can be granted access.

MEMBER KIRCHNER: But, then --

MS. CUBBAGE: But, I would expect that would be at the licensing stage.

MEMBER KIRCHNER: Would that include, say, the broader, I'll use the term which is pejorative, but I don't think it that way, intervener community.

MS. CUBBAGE: Yes, yes. Yes, and there are members of the intervener community who have gotten access to information to support their look at a design.

MR. RECKLEY: But, that's in a general sense. The further you progress, and then

definitely when you enter into the area of getting formal regulatory reviews, then the requirement is that enough information is made available to the public for them to participate.

MS. CUBBAGE: Right, right.

MR. RECKLEY: In the very early stages, I think you can imagine that there would be less and the companies may actually be more sensitive and claim proprietary business interest.

MS. CUBBAGE: Right.

MR. SEGALA: I mean, just looking at NuScale, the amount of information over the years that's been publically available until now when they've issued us their application and it's the whole FSAR is publically available, the level of information to the public has increased over time.

MEMBER REMPE: So, before you leave this slide, as I recall, and maybe I'm mis-remembering, one pre-application is a freebie from the NRC and then they need to pay, is that true?

MS. CUBBAGE: We have one kickoff meeting that's for planning and then thereafter everything is billed.

MEMBER REMPE: Okay, so probably both of the meetings, like for example, Oklo, they had

to pay because they'd already done their kickoff meeting earlier or they only paid for the --

MS. CUBBAGE: November was their kickoff meeting.

MEMBER REMPE: And, then the second one they paid? And, then something like NuScale, they had hundreds of meetings all before they ever got to their application. So, they're just looking at the tip of the iceberg here, basically, right?

MS. CUBBAGE: Tip of the iceberg, absolutely.

We've developed a core review team approach such that we have a small group of people across disciplines that are going to all of these meetings. We're trying to do this to maintain an efficient use of our resources. We don't need a hundred people coming to every meeting because they're interested.

Also, supports us having more consistent, you know, from meeting to meeting. It doesn't -- you don't have to, oh, well, what is Oklo? Well, these people have been in every meeting so they already have that base foundation.

They pull in additional people, if needed, in specific technical areas, but we're

trying to keep to that core team approach.

And, I think I can turn it over to Steve.

MR. BAJOREK: Okay, thank you very much.

Good morning, everyone. My name is Steve Bajorek from the Office of Research.

And, what I'd like to do is to focus on what we're calling Strategy 2. It's labeled computer codes, computer codes and tools, but really goes far beyond that. It's the idea is that Strategy 2 should lay the foundation, not only for our independent confirmatory analysis, but developing the database, the analytical capability to help the Agency in a very wide variety of areas.

In addition to looking at the codes over the near-term, one of the things that we're paying particular attention to are, what are going to be the experimental needs over the next several years?

Now, in many cases, the tests, the development of the test facilities and the data for things won't occur until the mid-term. It takes time for those things to be rooted out and to identify exactly what that is.

It also gets to be a very expensive part of a program. Our vision is that the applicant will be providing much of that information. There will be areas, however, in which the staff will have to participate, use some of those facilities, develop data in order to develop some of our regulatory decisions.

In particular, where we're going to need to develop a rule, regulatory guidance, things which are really beyond what the applicant needs to do to develop his design, but are supportive of these Strategies 3 and 5. Those are things which are still yet to be determined.

So, Strategy 2 goes well beyond just selecting a set of tools.

MEMBER POWERS: Steve, let's talk about the first point on your previous slide.

When we look at an SER on something, we find there are two categories of review that we encounter.

One is an examination of what the licensee has said and say, yea, verily the -- by the time it comes to us, yea, verily, what the licensee has said is true and valid.

The other category which is less

calming is the licensee has submitted an assessment. The staff said thank you very much, set that aside and did their own assessment.

And, so, and then, compare the two and say, yea, verily again, by the time it comes to yea, verily, the staff -- the applicant has either been confirmed or shown to be conservative in its assessment.

Did those -- the selection between those two types has become more a matter of precedent than anything else. In looking at this, on your first bullet there, are you reexamining that or are you saying no, we will continue to do in the true independent confirmation on the analyses as opposed to we're doing what the licensee did much as we've done before.

Or we'll go back and reassess and find a new criteria to decide between those, understanding full well, it is unlikely that you will go through and do an independent FSAR in its entirety, that there's always going to be something in one of the two categories.

MR. SEGALA: Let me add something here. I'll talk -- you can talk more specific, but, in general, with the NuScale application that's in

house right now, there's been a lot of looking at it as a follow up to KHMP.

What independent analyses should we be doing and when should we be doing them?

So, we've developed an internal, it's like a best practices brochure to try to focus the staff on just because the SRP says for a particular section, go off and do an independent analysis, do you really need it in this case? Look at things like margin and whatnot.

So, there is an activity undergoing with NuScale where we're trying to rethink where do we really need to be doing confirmatory analysis?

MR. BAJOREK: Now, first, it's a really good question because nowhere is it very clear for the staff to what extent you must do those confirmatory calculations.

We have the stuff in the standard review plan, but there's sort of a limit.

As we look at conventional reactors which are going through some changes, an upgrade or whatnot, we really don't need to do all the confirmatory analysis. And, I think we're starting to see that even more with NuScale right now, where there is a subset of accident scenarios which are

important.

And, I like to think of those as being important because if the applicant is wrong, the accident becomes worse than what you thought it was. The fission products get out containment or start spreading beyond that. So, you need to focus on things like that.

Do you need to go back and do everything? No, probably not. We're going to have to think carefully on that.

As we get to these new designs, we think that there is going to be the need for some confirmatory analysis. But, we're going to have took to Strategy 2 to start telling us what the risk of that accident is, what the likelihood is of that accident getting worse if somebody is incorrect on their calculations.

You know, I would hope that, you know, we focus only on those things which are the most safety significant or those things which are extremely difficult because we have that ignorance of some of the new phenomena.

MEMBER POWERS: I'm very appreciative of everything you've said. And, that's -- I mean, you're thinking about it and that's all that --

that's what you've said. We're thinking about it, we don't have a rigid standard for deciding which category things go into and that's probably the best you can do. But, you're thinking about it.

But, I certainly have encountered with some new designs pressure to adopt licensees computer codes that I find woefully poorly founded technical.

And, people saying -- and people not recognizing that not only is the code well founded, but the experimental database to support it is unanalyzable.

MR. BAJOREK: Well, that's true. I think there's really three reasons why you want to look at confirmatory analyses.

One, they have the opportunity actually to speed up the review. If you can show safety independent of what the applicant is showing, that should move that part of the review towards completion.

But, the other two reasons are, I think, is what you're hitting on, some of these codes are developed on antiquated bases.

If we look at the TRAC in the RELAP, these were codes developed back in the '70s and

'80s and, in some cases, go back. They have correlations going back into the early '60s. And, we have seen cases where an applicant comes in, gets one answer. We get something dramatically different.

In one case that Dr. March-Leuba may remember, one applicant said, we're down to TSAT where we said, gee, we're almost at the regulatory limit. What's wrong here?

Well, when we looked at it, we found a code that had been used again and again for years, had been used outside of its data based.

And, one correlation in there, which was applicable for its original intent was used in the wrong set of thermal hydraulic conditions and gave you drastically different answers.

And, that lends itself to the third thing, and I'll go back and reference Novak Zuber who was a consultant to this committee for a number of years who, when he demanded on having documentation as part of the CSAU methodology, it wasn't that he wanted more things to read, but it was the idea that you need to force people to understand what's inside the black box.

Because if you don't understand what's

in the black box, you're more likely to start using it for situations where you shouldn't.

And, we've seen too many cases where people are -- have picked up these older codes and misapplied them. So, I think that's the other reason why you need to have some level of the confirmatory calculations.

We try to keep our codes, the TRACE, the FRAPCON, FRAPTRAN, the MELCOR as state of the art as we can with the resources available.

Don't necessarily do that, if you've got an off the shelf code that has been approved and used it for years. So, it's something we're going to have to be careful about, especially with new applicants that don't have a long-term history of using some of these tools.

MEMBER RAY: Let me make a comment here. Appendix B's been mentioned a number of times. Appendix B, Criterion 3 has the requirement for independent confirmation.

When you encounter a situation like that, I guess the point of my comment is, the Agency shouldn't be in the position of performing independent verification in lieu of the applicant. It should be in addition to the applicant.

When a situation develops like you just touched on, it seems to me like there's a fundamental problem that has to then say, all right, time out. We've got to go back and address this fundamental problem.

Because you brought us something and applied for our approval, you're required to have independently confirmed what you brought us and you didn't. So, you didn't satisfy Criterion 3, in other words.

MS. CUBBAGE: I can't speak to the specifics of Steve's example, but when we find that an applicant has made an error, we will typically send a QA team down to do an inspection and then, they'll, as part of their inspection, they'll do an extent of condition and they'll keep going out and out and out to make sure that there isn't a problem throughout that organization.

MEMBER RAY: Yes, well, that's I guess the point. I guess it was just Steve's discussion of confirmation. I just want to make the point that the applicant is the first one required to do this.

MS. CUBBAGE: Definitely, always.

MEMBER RAY: Completely confirm.

MR. BAJOREK: Yes, the applicant -- that is the analysis of record and that's the one that it has to stand on. Ours is essentially there to help with the review and then help with our questions.

The Strategy 2, the next slide shows all the functional areas that we focused on starting back last July and August.

We asked each of the large functional areas, and then it's broken down primarily as you would do it for light water reactors. What do you see as being the major issues and the major work that needs to be done for molten salts, sodium fast and gas-cooled reactors?

CHAIRMAN BLEY: Can I sneak in a nontechnical point here? When I review those, we didn't call them functional areas or something and go through your document, they're not quite parallel, they're kind of different. And, I wonder if that's on purpose or just because different people were doing them and are you happy with that or do you need to revise this report?

MR. BAJOREK: Yes, it was designed by a committee. We --

CHAIRMAN BLEY: Yes, I mean there are

things in some areas that ought to be in all but don't show up there.

MR. BAJOREK: Yes, and --

CHAIRMAN BLEY: So, when are you going to fix that or do you need to?

MR. BAJOREK: I think we'll fix it as we go on.

CHAIRMAN BLEY: Before it goes up to the Commission?

MS. CUBBAGE: So, we can take a look at that. Ultimately, what we're living by is our execution, you know, so --

CHAIRMAN BLEY: Yes.

MS. CUBBAGE: -- we need to weigh how much time we spend revising this document and keep revising it versus what are we actually working on and focusing on the detailed work.

So, we'll take that into account when, you know, if we're going to do a rev, we might as well take a look if there's inconsistencies, we'll clean those up.

MR. BAJOREK: There could be and I --

CHAIRMAN BLEY: I think it's fairly important. It's like looking for gaps or like things seem to show up some places and not others

and I expect you want to do them across the board.

MS. CUBBAGE: And, there was a pretty right time line to get the document out, so I'm not surprised that you found some of those issues.

MR. BAJOREK: Yes, I think as we go forward, we'll see a lot more synergy between some of these areas. Probabilistic risk assessment is kind of more of a Strategy 3 type of activity. But, we'd be looking for that and Strategy 3 to help define what's the design basis versus beyond design basis? You know, give us some guidance there.

As we look at the types of systems we're looking at, we see things a lot more tightly coupled than we did in the light water reactor world.

Light water reactors, if you're looking at a large break LOCA, you get a large break to the system, the reactor shuts down because you avoid everything else. I mean, you don't need a nice tight coupling with neutronics and your kinetics codes.

As we're starting to look at sodium fast reactors and the molten salts and I think possibly, the gas-cooled reactors, we see a much,

much tighter coupling between the kinetics, thermal fluids and the fuel performance.

And, we're going to start looking at this in terms of a set of codes as opposed to a code to do this and a code to do that.

MEMBER CORRADINI: So, maybe you said it and I missed it, so you've already done the gap analysis? I'm looking for a gap analysis to say what --

So, let me just get to my question which is like, okay, I already have a case on the books relative to MHTGR and I already have a case on the books relative to PRISM and I did those, at least I got close to the end game on those with the tools I already have.

What are the gaps? I look for a potential design in those two areas. How do I fill those gaps? After that, I don't need to do anymore at this point.

MR. BAJOREK: We're getting to that and I think I have a slide coming up that'll --

MEMBER CORRADINI: Okay, because --

MR. BAJOREK: -- address that.

MEMBER CORRADINI: Because it kind of goes to Dick's question about, if somebody walks in

the door now, can you do it and, if you can't do it, what are the one or two or three things you need to do to be able to do it?

MR. BAJOREK: Okay.

CHAIRMAN BLEY: And, does this primary and secondary focus change as you move into the mid-term?

MR. BAJOREK: We'll start to see the secondary focus activities play a greater role.

Largely, when we looked at what we wanted to do in fiscal year '17 and '18, we said, let's focus on those things which have greater lead times. You know, if we need an analysis capability to look at a prototype reactor, there's some things we need to start on versus do we really need to look at control room habitability at this point?

Well, until we get the design information in and really see what the issues are with that design in the 2020s, there's no sense really starting on some of that work.

CHAIRMAN BLEY: I wonder a little, if our focus is on codes, this makes sense to me. I don't like that the focus is on codes, I think it ought to be on the things that underlie -- sit behind them. And, then, I get nervous about

putting I&C and human factors and security off to the kind of the back end of the thinking. Those aren't going to be driven by codes, those are going to be driven by other aspects.

But, getting them light is pretty important and getting your ideas of how you're going to chase them is pretty important.

MR. BAJOREK: Well, this is also from a research perspective. From the research and the security, not really our area.

Now, security I think is being addressed as part of the Strategy 3 and, you know, security by design is something that I think we're still going to -- we encourage the applicants to --

CHAIRMAN BLEY: This isn't a research group.

MS. CUBBAGE: Strategy 2 is focused on Office of Research activities to support the staff's readiness Strategies 1, 3, 5, you know, the other strategies are more --

CHAIRMAN BLEY: Well, where do human factors and security live --

MS. CUBBAGE: Okay, well --

CHAIRMAN BLEY: -- if they don't live in Strategy 2?

MS. CUBBAGE: Let me just say a few things about human factors. One primarily we don't have much information today to do a lot of thinking about what does human factors look like for a non-LWR versus a NuScale?

So, we're focusing in the top on the areas where we need to develop independent capability and where things are drastically different from an LWR. Materials, you get different materials. You've got high temperatures, you've got different accident phenomena, different fuels. You know, those things are important.

Things like human factors, I don't know what I would do with that today relative to what is a control room for a --

CHAIRMAN BLEY: Well, NuScale gives you some pretty good hints if you've been following what they're doing.

MS. CUBBAGE: Right. But, what do we need to do today to get ready for non-LWR control room?

CHAIRMAN BLEY: I think there's a fair amount.

MS. CUBBAGE: Today. I mean, we've got --

MR. RECKLEY: Well, but more specifically what new tools? And, the task --

CHAIRMAN BLEY: Well, see, now that's my problem. If the focus is on computer tools, I agree with you. But, to me, this Strategy 2 is about knowledge and filling in gaps in knowledge through experiment or a new analysis or developments.

MS. CUBBAGE: There's a lot --

CHAIRMAN BLEY: And, there --

MS. CUBBAGE: There's a lot of overlap in all of these things. Strategy 1 is getting people in training. Strategy --

CHAIRMAN BLEY: It smells like you're focus is on the tools here.

MS. CUBBAGE: Strategy 3 -- yes, that is correct.

MR. BAJOREK: For fiscal year '17 and '18, yes, we think that's going to be in the tools. Those other areas, it's not -- we're not saying we're not doing anything there. We are going to do some work on instrumentation and controls this year, probably more in the area of molten salt reactors where we're not so clear on the environment and whether the instrumentation that

you need is going to be appropriate for that.

So, it hasn't completely fallen off the table, they're just getting less emphasis until we get better educated on the designs themselves.

CHAIRMAN BLEY: Well, you know, if you look back over history, these things have always been pushed to the tail end and when the accidents come in, these things are always heavily involved in them. So, it's worth giving it.

MR. RECKLEY: Right and I'll just counter that, from DOE's perspective, they have a whole program on instrumentation for advanced reactors and high temperatures in specific. So, as they're developing, it's a matter of working out the timing of the NRC's activities related to the designers and DOE and some of these other activities.

MS. CUBBAGE: Yes, we can't be getting out ahead on all of these things.

MEMBER SKILLMAN: So, Steve, I'd like to ask this question. You hit a hot button for me and, perhaps for some others around the table when you mentioned that with the salt reactor and lead reactor, there's a different neutron spectra and, hence, a different reactivity scenario.

When we discussed the advanced reactor design criteria a couple weeks ago, criteria existing GDC 10 and 17 were kind of shuffled off by DOE from the perspective, all you need to shut down and control on reactivity and the fine words that many of us grew up with regarding control the reactivity or eliminate it.

The words that you just used ignited the importance, to me, of those words being in design criteria for a non-light water reactor because there are neutron spectra is different and, perhaps, with faster higher energy, much may need to be much faster than we saw in the light water family.

My question is, to what extent are the new criteria informed by research?

Let me say it differently, did you get your digs in when the new design criteria were being proposed so that those who adventure into molten salt, lead and other designs, really see a reactivity control requirement, can comment with the design spectra of those cores?

MR. BAJOREK: To that, I'd say no. We really have not worked closely with the ARDCs and defined what those are.

MEMBER SKILLMAN: Fair enough.

MR. BAJOREK: So, we're identifying issues and problems and the people who are working on kinetics, they point out it's a much, much different world dealing with the fast spectrum than it is -- than what we're used to. And, there are some things that we're going to have to be concerned about.

But, I don't know if we've really gotten to the point of working back and forth with the ARDCs on that yet.

MEMBER SKILLMAN: Okay, thank you.

MS. MAZZA: This is Jan Mazza, Project Manager for the ARDCs. I just want to say, we did have research on our team to the extent that they had -- were able to -- could either input, you know, was dependent on their team member.

MEMBER SKILLMAN: Okay.

MEMBER CORRADINI: Before you launch in, so, did I miss the slide or is it still coming about the gap analysis?

MR. BAJOREK: I think it's --

MEMBER CORRADINI: I'm still hot over about the gap analysis to understand what should I do first, second, third? What can I wait five or

ten years or never do?

MR. BAJOREK: If you can wait two slides, I think we're -- I think that will do that, so it might be five or ten years.

MEMBER POWERS: He is very poor at waiting. He is very poor at waiting.

(Laughter.)

MR. BAJOREK: I'm not going to try to go and list all of the technical challenges because that's one of the things that we are trying to identify here in the near-term. But, it's almost obvious through some of the cases.

First, it's -- we have to develop some staff familiarity. We have to look to Strategy 1.

We actually looked to some of the very excellent workshops that have been put on by EPRI and GAIN to help us get up to speed on what are some of the things that we need to be concerned about for each of these designs?

We look a fuels as being that first barrier. Of course, we think we understand U02 fairly well. As we start moving into TRISO, to fuel salts, other types of fuels, what are the concerns, the -- how we simulate the processes? And, those start to become very complex and a bit

of a mystery to us.

Neutronics, as we just pointed out, they are -- they very quickly point out the need to move towards a large number of energy groups in order to do their analysis.

And, for those designs that are more highly enriched than five percent, there's a lack of basic data and benchmark information that they see out there.

Severe accident phenomena, we're trying to get our hands around that. We think we're in good shape with the gas-cooled reactors. But, how is the fission products transported in sodium fast reactors? Molten salts? What happens when a molten salt solidifies and you know you have radiolysis occurring, giving off UF6 or some other type of a product that we need to be concerned with about.

One area that's actually fairly generic is that --

MEMBER POWERS: You're probably delighted if it's giving UF6 and to the cerium chloride.

MR. BAJOREK: One of the areas that is more generic at this point is that of materials.

Almost all of these designs are looking at outlet vessel temperatures 600, 700, 800 degrees C. We have a lot of work planned in order to try to look at and obtain data for the conditions under which these new systems would operate.

Looking at the corrosive environment that may occur for some for some of the --

MEMBER POWERS: Have you looked at the obligation of the applicant?

MR. BAJOREK: I'm sorry, say again?

MEMBER POWERS: Isn't that the obligation of the applicant?

MR. BAJOREK: Yes.

MEMBER POWERS: Did the materials be totally the focus of the applicant?

MR. BAJOREK: But, you know, going back and trying to find out what's out there now participating on codes and standards committees that you like, is something that they're going to do in order to try to better understand what should be the concerns for some of these new materials that are being proposed?

MS. CUBBAGE: Right. And, we need to be able to challenge the applicants. So, we need to have a level of knowledge as well.

MEMBER BALLINGER: I think we need to be careful when you say new materials. These are materials that exist, have been used in other applications but would be used in this application.

So, nobody's developing brand new materials, to my knowledge, with maybe the exception of fuel cladding.

MEMBER POWERS: Well the TRISO fuels --

MEMBER BALLINGER: Well, okay. When I think about materials, I think of anything but the fuel.

MEMBER POWERS: Anything but the fuel?

MEMBER BALLINGER: Yes, anything but the fuel.

MR. BAJOREK: No, and when I'm talking about materials here, I mean exactly that. It's the new types of Inconels, the new types of steels that they would use.

Yes, they currently exist but have they been irradiated for 40 years in a corrosive environment at 800 degrees C and --

MEMBER POWERS: It seems to me, I mean, I appreciate what you're saying, but it seems to me, the only question that you ask is, okay, where's your data for 40 years of irradiation at

the appropriate temperature with the appropriate flow velocities with episodic shutdowns for refueling? And, that's usually -- those combinations of things, especially I mean --

MR. BAJOREK: Well, which remains to be --

MEMBER POWERS: -- to do accelerated aging on these fuels without episodic shutdowns, that's where things -- materials go to hell on you is when you bring them up and down all the time.

And, to ask those questions is what you need and when the licensee says, well, I don't have that and I don't need it and then you say BS, go get me the experimental data.

That's the challenge for what -- I mean, your biggest challenge is the pressure to get this things through when there is an inadequate technical foundation for the work. That doesn't appear on anybody's list, but that is what the problem you're going to face on these things.

MEMBER BALLINGER: An even more important question is, how much data do I need? Because when light water reactors were developed, we certainly didn't have 40 years of irradiation data.

MR. BAJOREK: Right, and actually, you do see some diversity in designs. I've seen one when they say, well, we're going to replace the vessel every ten years. It seems like that's a very difficult thing to do and keep your capacity factor up.

But, they're talking about those types of replacements. So, we'll see.

MEMBER RAY: I think Dana's saying the same thing I was saying a different way and the same thing that Amy affirmed which is, what -- our capabilities should be for the purpose, not of confirming the analysis of the applicant, but of enabling us to challenge their analysis.

And, to send them back if that challenge shows that it's not adequate, their analysis.

So, sometimes we get in, it seems like to me, we get into the mind set of, well, we've got to be able to replicate what they've done. And, that, you know, isn't necessary or practical because they should not -- we should not be engaging with them if they can't show that they've complied with the requirements for themselves having inadequate basis of what they're proposing.

MR. BAJOREK: Yes, and I don't think we intended here to say that the NRC is doing parallel physical research but that this is challenge and we have to be aware.

One thing we do want to avoid however, is to have applicants or DOE have a program that's being going on for -- I take TRISO fuel as an example for 10 or 15 years and then, for us to come in in year 15 and say, well, you haven't proven your point, go back and do another 15 years' worth of data.

So, there has to be some engagement in real time in order to avoid that kind of an unnecessary impact.

MEMBER RAY: Yes, absolutely, Bill. And, I mean, I understand that. But, I also just think we want to make the point I just did, I won't repeat it.

MR. BAJOREK: Okay.

MEMBER RAY: But, you guys have an obligation as an applicant to show us that there's -- what you're presenting is invalidated. It's not our job to validate it.

MS. CUBBAGE: And, one thing I'd like to add in the materials area and I have basically

zero qualifications in materials, so I'll put that out there. But, some of the molten salt reactors, the materials are currently the impediment to them being able to move forward.

They may need to be developing new materials because the materials that they are using now would not be able to withstand the close environment for the long life that they want. They want these to be designed for 60 years and they're looking at, okay, this material might be good for five years.

So, I don't know if it's qualifying existing materials, developing new materials, but my understanding is that materials issues are a significant issue for molten salt reactors.

MEMBER BALLINGER: Yes, I think you're uninformed.

MS. CUBBAGE: I would agree with that, and if there's anybody in the audience that has more information on that, I'd be happy to --

MEMBER MARCH-LEUBA: Going back to the previous topic, I think there the responsibility of the staff is to get ready to challenge those results and the applicants will.

And the question is how do you do that

and what this staff should do and I think is doing is trying to develop internal expertise to have some insights, to have some engineering knowledge, to have some physics knowledge.

And, the question is, do you do that by giving the young engineers a couple of books and saying go read them? Or do you have to be hands on, run the code, see they result, run some experiments?

And, I would say that the second part is better than just reading a couple of books. Because there is absolutely no expertise inside the house on molten salt. Nobody has -- nobody can even tell you what the properties are.

MEMBER REMPE: But, along those lines, again, I appreciate eventually you need words important to be able to independently confirm or disagree with some of the results. But, rather than just having a textbook to look at, maybe it'd be good to look at their ill-founded, based on the erroneous physics codes and use their codes rather than starting out in trying to improve the existing in house tools just to try and do something less expensive to gain some insights.

Because, basically, you're just trying

to gain the expertise to know where to challenge them.

MEMBER POWERS: The problem I see with that strategy is that, when you run a code, you develop a relationship to that code that is akin to marriage. And, you start believing the results.

MR. BAJOREK: It depends on how you believe in their --

MEMBER REMPE: It depends on how you --

(Simultaneous speaking.)

MEMBER REMPE: -- you just start attaching to your codes, I think. And, you may be right in some ways, but for the existing on --

MEMBER POWERS: I mean, I make no bones about that. I know this from personal experience that I write a computer code, I tend to believe the results.

And, even in the face of contrary evidence, I say, well, they must have screwed up the experiment because it's not the result my code got. And, it's true of my own codes.

And, if I recently was privy to a computer severe accident analysis that was totally orthogonal to what you would manifestly guess would happen. And, yet, people were perfectly willing to

believe -- to present it to me and this is what the code said. How can it possibly be wrong? Because it left out the melting point of the material involved.

You know, trying to arrive intuition from a code that is very new and not well established phenomenologically is just a move to persuading yourself and not doing what Amy said the objective is to this challenge thing.

It's much better to do what Ron says is look at the vast array of experience with the materials or whatever in other applications. It's much more useful, too.

MEMBER MARCH-LEUBA: Yes, but I think that the staff needs to keep very focused on the goal which is to the develop internal expertise to be able to challenge the applicant. And, that's what you're doing.

And, in my opinion, if I was the king of the world, what I would do is, I would take whatever code is available and start benchmarking it against everything that's available.

Forget about writing new software, forget the new software wise for Steve. Give us available and benchmark it and see where it fails.

MEMBER REMPE: Because, when there's not adequate data to support things, trying to get -- attach -- develop your own code and getting attached to it could lead you along the same path.

MEMBER MARCH-LEUBA: Yes. And, you tend to emphasize whether somebody else's code.

MEMBER REMPE: Yes.

CHAIRMAN BLEY: Let's go to the next one.

MR. BAJOREK: There are a lot of challenges, also some benefits as we start to look at the path forward. As I think -- as we've mentioned before, the staff had done a lot of work for PBMR and NGNP.

We think we know what the issues are and what the path forward is for the gas-cooled reactor. So, we're --

MEMBER POWERS: You more than I do then.

(Laughter.)

MR. BAJOREK: This is relative to the other two.

MEMBER POWERS: And, that's true of so many things in your case, Steve, that you know more than I do.

(Laughter.)

MR. BAJOREK: In comparison to the other reactors, we think we're in much better shape when it comes to selecting the tools and where we think the issues are.

For the most part, we're really looking at single phase phenomena now apart from sodium boiling, molten salt solidification which are conditions you probably just want to avoid as part of the design as opposed to the fun we have with two phased flow, critical heat flux, non-equilibrium that we deal with in light water reactors.

MEMBER POWERS: You know, I just found that a remarkable line in your view graph because the -- when I think about it, I think about molten salts, they said what is the problem with molten salts?

Well, if you carry off little particles of corrosion products and then we get an abrasion component to the attack, that's not -- so it's no longer is the safety issue single phase flow, it is, in fact, two phase flow where you have a solid component in there.

When I asked the CFD people about this,

they said, well, we really don't do that very well or particles tend to be points. We don't have a good way to account for abrasion.

When I think of your gas-cooled reactor, I say, you know, what is the safety issue? Well, gee, it's the gas carries off fission products that are typically in the form of aerosols. I ask the CFD people and it's, oh, we're really good at that.

We have this point model that doesn't account for diffusion. Oh, gosh, that's not a small issue there. It doesn't account for the phoretic phenomena. That, too, is not a small issue there for the aerosol fission.

So, the comment surprised me that it's single phase, though. Because I think the safety issues all arise because it's not single phased flow.

MEMBER KIRCHNER: If I might jump in here. Yes, I was looking at that, too. And, then, I was thinking, you know, just about every reactor concept that's probably going to come forward has been designed and many have been built before in some small prototype fashion.

And, over these 50 years of nuclear

power, we've evolved away from liquid fueled reactors for a lot of reasons, one being the uncertainty is, you know don't know where the fuel is with quite the precision of a fixed geometry.

So, actually, I was struck by this as well. It's to be determined whether you have significant safety margins. And, again, in the spirit of being able to challenge the applicants, it strikes me that the -- and I think your next slide, it actually hints at it.

You've got tight coupling of fuel and neutronics and thermal performance. And, it seems to me reliable assessment.

I note that the GDC, the advanced GDC 26 strikes reliable control of reactivity which we'll address, I guess, tomorrow.

But, that is probably the crux of some of these designs, probably the most important safety issue that you're going to have to be able to analyze and challenge. Because that's probably one of the largest contributors to, quote, unquote, risk in those designs.

MEMBER BROWN: Okay, I can't resist it now any more.

I looked through the rest of the

slides. I have a hard time understanding why we focus a little bit what we're saying, okay, here, we're going to tap the technical benefits in terms of why it makes it easier for us to do things as opposed to a slide that shows the risks involved with the utilization of these other types of reactors.

The disadvantages of them, the time in which they've been built in the past and been not built again and, instead, I mean that's, to me, ought to be, along Dana's point, we ought to be assessing the risks involved of these particular plans.

What are the things we want the applicants to demonstrate to us how they ameliorate those risks so that we don't have to deal with public safety?

We understand the light water reactors, they've been around for 60, 67, no, since what, 1954, roughly when SIW or S52, whatever it was, when the S1W, the naval nuclear reactor went critical.

So, we've got a huge wealth of data on that and we continue to proliferate those over the last 67 years or so.

But, to focus on benefits of analysis or single phased -- I like that, it's a good idea. They don't have high pressures and things like that.

But, their disadvantages, you know, of your materials that you have to deal with, the corrosion, the how you transfer, you know, the heat into another viable medium which allows you to generate electricity, that whole how you deal with that and we're not focusing on that.

MS. CUBBAGE: Well, I'd like to say that this slide was poorly titled. This is reflecting --

MEMBER BROWN: That's an understatement.

MS. CUBBAGE: -- this was -- yes. So, this was just reflecting -- Steve was trying to say in the code world, he's saying there's things about this that make it hard and there's things about it that aren't as challenging and that is not trying to advertise --

MEMBER BROWN: No, it's not that you're --

(Simultaneous speaking.)

MR. BAJOREK: -- significant margin,

it's still a tough sell.

MEMBER BROWN: Yes, I understand.

MR. BAJOREK: Okay, there's a lot that has to go into that. Do we have the data to do that? No. From the limited information that people presented, there might be a lot of margin there.

If that is true, if that can be shown, experimentally and conclusively with your analysis, you allow yourself some larger uncertainties than you do with a light water reactor which is already been ratcheted right up to the regulatory limit.

MEMBER BROWN: My difficulty is that you're being asked by some of these to provide a set of regulatory assessments of whether it is a viable go forward type process for them when, in fact, you have little, if any, information, background information to make those judgments.

I would -- I just think that's a slippery slope to even do that. Instead, to me, you'd be going back and telling, here are the downsides. Here are the risks to the public. How does your design prevent and ensure those don't occur for the next 40 years?

That's the question that ought to be

asked. You shouldn't be confirming anything in my own mind. You should be getting them to tell you why it's okay.

That's what was -- and that's what was done 60-something years ago when we started this process. And, we didn't build the first reactors to last for 40 years. The first one was only designed for about 18 months of operation.

We knew we couldn't build submarines that only had to be refueled every 18 months. I mean, I learned that lesson heavily in 1965 when I went to work for the program.

MS. CUBBAGE: I'll give a counterpoint, the Commission has an advanced reactor policy statement which encourages inherent simple, passive designs.

These designs are professing to have inherency characteristics, many of which have yet to be proven, but that's -- this is --

MEMBER BROWN: But, they're relative to light water reactors.

MS. CUBBAGE: Yes.

MEMBER BROWN: That's -- every one of these is relative to a light water reactor. When really, they're not addressing -- you haven't

looked at where are -- how are they addressing the risks to the public from these particular design approaches?

And, I haven't seen a thrust in your -- I mean, I read through your IAPs and everything else, and I don't have any big problem. You all were doing a pretty thorough job of trying to assess things. But, it's not relative to the risk.

So, I'm -- I guess maybe I've said my peace and maybe I will allow you to continue. But, that's my difficulty with the whole thing.

MS. CUBBAGE: Risk is going to underpin everything we do and safety, that's --

MEMBER BROWN: But, it's not being addressed. I mean, you haven't gone -- instead of challenging these folks to come in and tell you, how do I avoid all the downsides? And, you don't have any information or experimental data to show me why this is going to last for the time you -- why -- how can you give an assessment that looks like a viable path?

I have a hard time of walking down that road. If I was the Agency, I wouldn't want to do that.

MEMBER CORRADINI: I don't mean to take

your side, Charlie, but --

MEMBER BROWN: I know you, you're going to. But, I'm going to -- it doesn't matter.

MEMBER CORRADINI: I think what they're saying is, as people -- as what I thought they were saying is, as potential applicants come up with designs or concepts, they want to be flexible to ask what I'll call penetrating questions up front that they'll -- the applicant, potential applicant, will come scratching his head and say, okay, be back to you in a month, a year, three years.

MS. CUBBAGE: Never, maybe.

MEMBER CORRADINI: Or not.

MS. CUBBAGE: No, I'm saying if we identify a fatal flaw, I mean, that's part of the process, too.

MEMBER CORRADINI: It's happened before.

MS. CUBBAGE: Yes.

MR. BAJOREK: Okay, think back a little to my first slide, one of the things that we're going to come out of the next thing is going to be identification of those experimental needs. That's the thing that's going to drive. Do you have the data to show that margin?

That step in coming up. We don't know it yet. We only have the information that we've been presented to this point. We take it at face value.

Now, in initial efforts, going to wake Dr. Corradini up, so this is the slide.

MS. CUBBAGE: Oh, this is the slide you were waiting for. That's why he was --

MR. BAJOREK: So, what are we doing to get started and really identify where the true issues are?

Our first -- our focus in virtually all of those areas is identification on the phenomena, the scenarios and the issues that are going to drive the code selection and the needs for the experimental data.

CHAIRMAN BLEY: I like hearing that. I don't like the focus on codes so much, but okay, I like hearing that. But, when I read the document, here was the place where I saw, for some of them, my criticality, well, you read it, and this is what is what it says.

For others, it reads as if, we already know this stuff and we're going to the following things. And, that's where I saw the inconsistency.

And, it especially bothered me because the focus on identifying technical gaps where we need to really understand things better didn't seem to be consistently applied across the functional areas.

MR. BAJOREK: That's --

MS. CUBBAGE: That delta B function, we've already done the certs on the gas reactors. We already got an --

MR. BAJOREK: Gas-cooled reactors, yes, we've done some of that work. But, we've already started two projects going to be for molten salt, going to be sodium fast reactors.

I call them more of the pre-PIRT type of evaluation. But, we're going to go back and review the existing information from things like EBR2, from Fermi, Clinch River, the PRISM for the sodium fast, look at the MSRE and the aircraft reactor for molten salt reactor to identify what were the things that were of most concern in those designs?

What type scenarios? We're not going to be able to get to the licensing basis versus nonlicensing basis at this point. But, we already kind of know from those things that cause

stagnation in the flow, loss of flow.

Those tended to be more problematic to those types of designs. Flow blockages in some of the assemblies. Yes, we've seen that come up as a recurring theme.

So, we're going to start looking at those. And, the idea is to come out of these pre-PIRT exercises with a list of phenomena and issues that you're going to need to account for in these codes and in your analytical tools.

MEMBER CORRADINI: So, I'm with Dennis. I think the first bullet is -- makes me feel good. So, now, let me ask the question, if tomorrow, which one was it up there, Terrestrial, no let's not pick that, let's Oklo since it's a sodium reactor.

Company X comes in and says we actually want to start pursuing a certification or a Part 50 construction activity or somewhere in this pathway on a sodium reactor or somebody comes in like X Energy for a gas reactor.

And, you said to Dick, you're right, what I'm looking for is, okay, if you're ready without this code, that code, this code, what would you do in terms of a process to address it in the

next five years?

Because you won't have the information of some of these. And, that's where I'm -- that's where the gap analysis, to me, fits -- would fit in. Because, then, you can address issues like I know Dr. Powers has been sending me little missives on source term.

Because source term affects EPZ, it affects containment performance, functional requirements, and so on.

So, it seems to me that's where in the writing that we got, I was missing that sort of, if they come in in the next few years, how do I do it practically?

MR. BAJOREK: Initially, and when you do the part, you really do it in -- there's two issues. What are the phenomena? And, how well do you know them?

We would look for this in on a generic basis that we -- these are the phenomena, how well do we understand them? And, invariably, you're going to -- what I -- start your gap analysis. Are those things where? Yes, this is important for these designs, we don't know anything about it.

MEMBER CORRADINI: Okay.

MR. BAJOREK: And, that basically starts it, okay, you need to go down an experimental path.

MEMBER CORRADINI: But, the only reason I'm suggesting this as an activity, which you can choose to ignore is, it addresses Charlie's point, which is, in the next N years, N being less than five, you're not going to be necessarily have all additional data.

You're going to have the data you've got, you've got the analysis tools you've got and you've got the potential risk from older designs and their performance. And, now, you've got to deal with it.

So, it seems me you're going to also have to have a pilot on how you would address a potential applicant when one of these many stages that Bill was saying that's the sodium, that's gas, and that's an other. And, that's how I might organize my thoughts in the first five years so that I practically know how I would attack it.

And, then, you can say that when they come in, you say, well, you know, this looks like a deficiency in materials, geez, you better go back and do X.

Or, we always saw when Oak Ridge ran their whatever it is under the chemical engineering codes and standards, it still dissolved the hell out of the materials, so you've got to go do Y.

That's what I guess I'm --

(Simultaneous speaking.)

MEMBER RAY: Well, let me weigh in here for a second.

You talked about Part 52 versus Part 50. There used to be a time when there was thing called a provisional operating license.

Charlie talked about 40 years. I can't envision, conceivably, issuing a license for 40 years on some of these designs where you're never going to have the material properties except as you monitor it on an ongoing basis.

So, surely, and this now becomes a question, surely, we anticipate the possibility that there is going to need to be, whether we call it a provision license, which we don't have a provision for any more, but or not, there's going to be -- have to be, for the initial suite of plants of any design some monitoring that deals with the long-term potential effects that we can't have the data for because it's just not going to be

available. Is that not correct?

MR. RECKLEY: That is absolutely correct that you have to look at, when you're doing the licensing process, not only the design, but the operational aspects that'll be put in place, including the monitoring.

And, that ranges from the use of an actual prototype provision which is somewhat similar to a provisional, but --

MEMBER RAY: That's right.

MR. RECKLEY: -- in that first reactor is actually being used to gather data that would be used for subsequent reactors is basically the way that prototype provision.

But, even if it's not a prototype, there'll be operational constraints just like there are for light water reactors that include monitoring and then making adjustments if the behavior is different than what you expect.

MEMBER RAY: Yes, but, Bill, I mean, realistically, the monitoring of light water reactors has gone down and down and down over the years, it's going to be at a pretty high level, it seems to me, for many of these new concepts in terms of frequency and extent of monitoring that's

required.

And, people need to understand if they're going out and financing something on the basis that they're going to operate it for 40 years and they have a guarantee of being able to do so, it's got to be clear that that's only if all of the monitoring supports doing that.

And, they may shutdown in five years or whatever.

MR. RECKLEY: That's a possibility if it doesn't behave the way it's expected.

MEMBER RAY: Well, it needs to be explicit. It seems to me everybody needs to understand that there's not going to be any guarantees.

MEMBER MARCH-LEUBA: Well, from the relative point of view, how is this different from changing a silt-based cladding hydrides from by a new alloy? That doesn't have 40 years' experience.

You put it in and you hope it works and you monitor it.

MEMBER RAY: Well, my point is that it's not different, it's simply that it needs to be explicit and I really am responding to Charlie's point and I thought that Mike was repeating it

somewhat, which was you've got to go get data that doesn't exist presently because it's needed in order to show that this thing will be able to operate for 40 years.

Well, maybe the only data that's going to show that is the data that is created by the operation of the plant in the first place.

So, you simply have to say, all right, we're going to have to shut down or, you know, monitor this parameter frequently until we can establish what -- how it's behaving.

MEMBER CORRADINI: I elicited Bill's phenomena prototype, I'm happy.

MS. CUBBAGE: And, I'd like to just follow up. All good ideas and I think the issue comes down to, do we have enough information such there won't be a safety issue that wouldn't -- that would manifest and the monitoring wouldn't pick it up?

You know, in that case, you need more information.

MEMBER CORRADINI: Well, of course.

MEMBER RAY: Yes, but if --

MS. CUBBAGE: But, if you have enough information to say, we expect the behavior to be X

and then you're going to monitor it and make sure it behaves, and if it doesn't, you have course corrections. Then that's more like a normal operating reactor. We could put appropriate monitoring in place.

But, if it's more like we don't have enough data to justify this safety, then, you get into more of, you either need to do more testing to get a license or you could be in that gray area of maybe it's a prototype.

MEMBER RAY: Yes, we're all in agreement, I think.

MS. CUBBAGE: Yes.

MEMBER RAY: It's just I think it needs to be clear enough that this isn't just like plants that have been operating for a long period of time relative to assurance that we're not going to look at this issue as the plant enters operation.

CHAIRMAN BLEY: I'm going to interrupt the discussion at this point.

MEMBER BROWN: Can I, before you do, can I just finish off this thought for two seconds?

But, Harold's exactly the point, that is how, exactly how all the initial design approaches that were taken with the naval nuclear

program so they could move on.

They were put in place, the prototypes were in place. There were ways to access information, you know, material, stuff that was put in those that were monitored then pulled out and then looked at so that we could then extend that life time and move on to the other reactors.

And, that ought to be a part of your thinking. That's all Harold's thinking or saying, is that that ought to be -- if you're going to do these different designs, assign those risks, how do you do it? How do you get -- now build up that database so you can do it, that's all I wanted to amplify. That's how it was done in the past, it worked.

MS. CUBBAGE: Yes, and we don't control the business. You know, we don't control the applicants, they have business models. We're not the Navy and we can't dictate that you're going to build an RTR, you're going to do this, you're going to do this.

CHAIRMAN BLEY: And, you don't have to approve it for 40 years.

MS. CUBBAGE: You don't have to approve it. You're absolutely right, but my point is,

Design X may want to come first with an research test reactor. Design Y might want to come first with a prototype. You know, Design Z may want to come in first with a full scale commercial reactor and they'll have to demonstrate that they have the data to support that.

CHAIRMAN BLEY: And, you don't have to approve it for a 100 percent power.

MS. CUBBAGE: Exactly.

CHAIRMAN BLEY: But, at this point, I'm going to stop the discussion. I'm going to --

(Laughter.)

CHAIRMAN BLEY: -- going to announce that Dr. Peter Riccardella has joined us on the committee.

And, we are going to -- I was going to wait until you were done, but we're going to take a break now and we'll come back at 10 minutes until 11:00.

We are in recess.

(Whereupon, the above-entitled matter went off the record at 10:35 a.m. and resumed at 10:52 a.m.)

CHAIRMAN BLEY: We are back in session. Give it back to you Steve. Not that you have many

left.

MS. CUBBAGE: But before --

CHAIRMAN BLEY: Oh, okay.

MS. CUBBAGE: Before Steve starts and where did Mike go? Mike needs to sit down.

MEMBER POWERS: No. It's not that he sits down. He's -- be quiet.

MS. CUBBAGE: He needs to be quiet.

MEMBER POWERS: And that's much harder to achieve.

MS. CUBBAGE: So I just wanted to close the loop on one thing. Mike was, you know, hitting on the topic of gaps. And I just wanted to make it clear that while Strategy 2 happens to be the most voluminous in the document, that was just quite frankly by nature of the fact that different people pull different pieces together, it all got put together at the end.

We didn't really have time to beef up certain sections and compress other sections. We felt that there was a lot of good information in the Strategy 2 area. So it really wasn't worth pulling it all out.

But, I say that because the -- identifying regulatory gaps is actually a Strategy

3 topic. And it has just as much emphasis for us as the other Strategies.

So it all has to work together. It's all overlapping. And the gaps identified in Strategy 3 plus the resolution of policy issues in Strategy 5, that all feeds into what you need to do in Strategy 2.

I kind of inherited this framework of all the separate Strategies. If I had to do it over again, it would be written differently.

MEMBER CORRADINI: But since you're now -- since you're now in -- since you now own it.

MS. CUBBAGE: I own it. And I'm stuck with all these different bins. And it -- and then we try to figure out, well is that a Strategy 2 activity or a 4 activity? And does it really matter?

It doesn't matter. We just need to be working on the right things in a smart way.

MEMBER CORRADINI: Is the -- so, let me just take that. Is the roadmap where I would look to see how these are knit together? Where do I --

MS. CUBBAGE: No.

MEMBER CORRADINI: Or is it still to be knitted?

MS. CUBBAGE: The roadmap is a specific Strategy 3 topic that Bill will get to.

MEMBER CORRADINI: Okay.

MS. CUBBAGE: And that's how people would interact with us in licensing.

MEMBER CORRADINI: Okay.

MS. CUBBAGE: So that's licensing strategies.

MEMBER CORRADINI: But I do think that since you brought this up, which is a, I think, an important point. The knitting together on how these six things fit either temporally or organizationally is important.

MS. CUBBAGE: And it resides in my brain.

MS. CORRADINI: Okay.

MEMBER REMPE: So, it doesn't entirely reside in your brain. If I read the document in Strategy 2, it looks like an all of the above strategy. Where there's detailed tasks for gas reactors, sodium reactors, and molten salt reactors with detailed model changes and things like that that are identified for fiscal year '17 and on out each year.

And it's a substantial -- and that was

my comment earlier, this is a few bucks that you're expending there. And knowing that there's a lot of uncertainty, I mean, I like the words here on the slide. They're very high level and generic.

When you get down to some of these detailed tasks with bucks associated to it, I'm not sure it's knitted together and working wisely like your last comment.

And maybe there ought to be some changes.

MS. CUBBAGE: I have internal working documents that are execution strategies for '17 as far as what we're actually working on. Steve has developed one that's specific to code development aspects.

And it is along the lines of the slides where we're doing pre-PIRTs. And we're assessing what's out there.

MEMBER REMPE: What's in Volume --

MS. CUBBAGE: And more exploratory.

MEMBER REMPE: So what's in Volume Two that's not publically available, we should assume it is going to be changed before it goes to the Commissioners?

MS. CUBBAGE: It -- we're in this --

MR. BAJOREK: It's certainly going to get shuffled around. A lot of that went into that Strategy 2, those IAPs, some have already been pushed out to further years.

What we're really going to be able to accomplish in fiscal year '17 and much of '18 went through a more recent review. Developing models, selecting individual models and correlations, that's been really put off.

MEMBER REMPE: Yes. That was what distressed me. And so I -- again, we were doing something that's been changed. And so I guess I will conclude --

MS. CUBBAGE: I wouldn't necessarily say it's been changed. You've got to look at what the purpose of that document was.

It was a snapshot that was written frankly back in August, before we got into the work. It was to generally inform budget requests. It wasn't intended to be what -- a detailed execution strategy by fiscal year.

It was, these are the types of things we need to do. This is how we're going to come up with a rough estimate of the resources because we budget multiple years out.

My problem is, is if I spend my whole life keeping this document updated all the time, I don't get to do other work. So, we need to balance, was this a snapshot planning tool? Or is this really going to be a detailed work plan?

And my druthers would be this is kind of like, okay, that was a snapshot. And when it gets into detailed budget formulation, then we get into more specifics.

MEMBER REMPE: Thanks. This helps me and comforts me.

MS. CUBBAGE: Okay.

MEMBER MARCH-LEUBA: In the same topic, don't move. In my mind, what we're doing here on item two is trading up from cost of setting up all these tools. Versus delays when somebody actually gets to submit something.

MS. CUBBAGE: Right. Exactly.

MEMBER MARCH-LEUBA: So, and the risk we're running with -- or the public is running, is that if you don't have these half-done costs when the submittal comes and the pressure not to do it because we don't have time.

MS. CUBBAGE: Right. You're absolutely right. That is the dilemma we're in. Do we invest

a lot of money to be ready for something that may or may not come, or may, or may not come on the schedule advertised? Or do we risk it showing up and we're not ready?

And we have to balance that. And we're keeping our eyes open, weighing all the information that's out there. And trying to responsibly use our resources as Steve has --

MEMBER MARCH-LEUBA: So, as a part of all these gap analysis that we keep talking about, --

MS. CUBBAGE: Yes.

MEMBER MARCH-LEUBA: You should be prioritizing a sense of what takes longer, and what is more likely to be used. Which is obviously what you're going to do.

MS. CUBBAGE: Right. Right. The what takes longer, 100 percent factors into the plans. The what is more likely is a very difficult balancing act.

We can't pick winners and losers. We have to go --

MEMBER MARCH-LEUBA: The risk I see is, DOE is going to come with, and now you have to do this one.

MS. CUBBAGE: Right.

MEMBER MARCH-LEUBA: And you're not ready. And then you should then stomp your feet down and say, we're not ready because we didn't have the money. We are going to -- you come back in five years.

MS. CUBBAGE: Right.

MEMBER MARCH-LEUBA: Or, you succumb to political pressure and not do it.

MS. CUBBAGE: You basically surmised our whole problem right there.

CHAIRMAN BLEY: Amy?

MS. CUBBAGE: Yes?

CHAIRMAN BLEY: Tomorrow we'll have another meeting on this same thing.

MS. CUBBAGE: Yes.

CHAIRMAN BLEY: And then we'll be talking about us fighting the letter.

MR. BAJOREK: Can I please ask --

CHAIRMAN BLEY: Do you want us to think about that letter the way you just said? That this was a snapshot in time and it isn't a plan for going forward?

MS. CUBBAGE: It's a snapshot in time. And it should be viewed as this is the general body

of work we plan to do in the first five years.

CHAIRMAN BLEY: Except you've already said you know a lot of it isn't going to be in the first five years.

MS. CUBBAGE: Well, what we're doing is we're not necessarily doing in '17 what it said we would do in '17 because availability --

CHAIRMAN BLEY: But it hasn't moved to midterm. You think these are still --

MS. CUBBAGE: It hasn't moved to midterm.

CHAIRMAN BLEY: Short term.

MS. CUBBAGE: Right.

CHAIRMAN BLEY: Okay.

MR. BAJOREK: Yes. I think part of the problem is you have the full IAPs in those two large documents. And you don't have the December sanitation that we went through where we decided hey, we're changing some priorities.

We're taking some tasks that people said yes, we've got to do those. And we said, no, you don't. You don't need to do those right away. And in some cases there were things for gas-cooled reactors that we'd probably done.

You know, so we've cleaned up a lot of

that. But I'm not so sure.

CHAIRMAN BLEY: And we don't anywhere, as far as I know, have anything that plays out to our priorities. You talk that if we don't get all the money, things will get spread out.

But, which comes first seems not to be identified and -- if the documents were reviewed in any case.

MS. CUBBAGE: Right. So that's where going all the way back to, you know, to this one. So --

CHAIRMAN BLEY: I like that one. But under Strategy 4 the third little green box, I don't see that in this file.

MS. CUBBAGE: Under Strategy -- right. Because that's new work. So, --

CHAIRMAN BLEY: And they're like the others. I didn't check for the others.

MS. CUBBAGE: Right. So NEI sent us a letter after the document was issued. They want to engage on licensing basis of in selection PRA, using the -- and that will need the non-LWR PRA standard to support it and other activities.

So, you know, it's a very fluid area. We're moving, we're reacting to what industry

wants. We're meeting with stakeholders every six weeks.

We're kind of continually adjusting, all right, we'll work on this.

MEMBER CORRADINI: But I think, I mean, to get to Dennis points, and as the Chair of the Committee, he's worried about at least giving us a first cut at what our response might be.

MS. CUBBAGE: Right.

MEMBER CORRADINI: If we want to make a response. What I heard you say about Strategy 3 and 5, I'll just repeat to make sure I didn't hear it incorrectly.

Which is, in some sense if one were to knit together an action plan on how these all are knitted together, 3 and 5 will drive the train. Because within 3 is a gap analysis. Within 3 is event -- at least a methodology to determine events.

MS. CUBBAGE: Right.

MEMBER CORRADINI: There could be design basis or beyond basis. Under 5 there are policies that have to be discussed.

MS. CUBBAGE: Yes.

MEMBER CORRADINI: I think when we had

the February meeting you at least mentioned one on containment functional performance requirements.

MS. CUBBAGE: Right.

MEMBER CORRADINI: So to me, what I heard you say was, that 3 and 5 tends to drive this forward.

MS. CUBBAGE: It drives except Strategy 2 was such a long lead issue that Steve and his colleagues are today looking at what's out there.

MEMBER CORRADINI: I understand.

MS. CUBBAGE: You know, getting up to speed. So you kind of have to do all of this in parallel.

MEMBER CORRADINI: But if -- but if -- and just one last thing. So, if you didn't get the resources you needed, then there's got to be a backup plan or two since it's so extensive, that there is something already available that might require current tools, applicants' tools and us doing auditing. There's got to be other ways to attack that problem in case you don't get the resources you need.

MS. CUBBAGE: Quite frankly right now I'm less worried about getting the resources then, you know, maybe some areas where we have critical

skill gaps.

MEMBER CORRADINI: Okay.

MS. CUBBAGE: And we're working on those. But I think the issue is more, if we get application sooner than anticipated. If --

MEMBER CORRADINI: Okay. Okay.

MS. CUBBAGE: That's the real rub.

MEMBER CORRADINI: Thank you.

MEMBER REMPE: Well, I'd like to go back to Dennis' question and your response back. Because you said oh, no. We're still going to do all this stuff in the near term. It's just it may not happen in fiscal year '17 or '18.

And I look at this plan, and there were activities '17, '18, '19, '20, and '21 all identified. And so is your vision -- again, it was an all of the above approach.

Is your vision, we get an applicant for one design. And then we do all of these tasks for that one and you prioritize? Instead of the -- every gas reactor, sodium reactor, and whatever reactor?

MS. CUBBAGE: We're keeping our eyes wide open. Right now we have people that want to come in in all three categories. So we are really

--

MEMBER REMPE: So how do you compress and get it all done in the near term if again, it's been delayed is what I hear. But you still think all of these activities are needed in the near term?

MR. BAJOREK: Well, if the applicants keep that diversity of design, yes. Yes. If they sort themselves out in a couple of years and it starts to gravitate towards one or the other, we'll be able to reduce some of those costs --

MEMBER REMPE: Right. Right.

MR. BAJOREK: And resources.

MR. SEGALA: So the IAPs were developed independent of the budget, independent of critical skills, independent of applicant plans. And the whole idea was to write down, what is all the things we need to do to get ready.

MEMBER REMPE: It's an all of the events strategy.

MR. SEGALA: All yes. And so, we're going to constantly have to do course correction depending on what the applicants want, how much budget we have, what kind of critical skills we have.

And so we're constantly going through looking at all those. Looking at work priorities in the office and how to make adjustments.

And so we're having -- it's very fluid. We're having very frequent communications with all the offices. You know, can you support this activity? When can you get it done? Do you have the bodies? All that kind of stuff.

And then going through prioritization and whatnot, so.

MS. CUBBAGE: And being responsible stewards of our resources, we don't want to go crazy in the first year. You know, we're kind of seeing where things are going.

MEMBER REMPE: Another backup plan would be to have the applicant that comes in pay for some of these activities for Strategy 2.

MS. CUBBAGE: If they are a specific applicant and we are working on stuff for their specific design, absolutely. Under our current fee structure, they would be billable.

MR. SEGALA: And the other thing I want to add is, you know, when we developed the IAPs, this listed everything that needs to get done. In some cases, if you go back to that green sheet, as

Amy indicted, NEI is coming in with a licensing basis event selection. That's something that we had planned to work on.

So, not everything in the IAPs is going to be done by NRC. We're going to do some of it in-house. Some of it industry may do. And we may endorse it in a Reg Guide.

DOE may do pieces of it. I think they'll come and talk about that. And that we can leverage work that other organizations are doing.

So, it's kind of a complicated thing to weave together.

MEMBER SKILLMAN: May I please ask Steve a --

CHAIRMAN BLEY: Yes. Go ahead.

MEMBER SKILLMAN: Steve, on your second bullet there --

MS. CUBBAGE: This one?

MEMBER SKILLMAN: That. Slide 18. The second slash may involve NRC developed codes and so on. What is the agency's appetite for well vetted foreign codes?

Codes that may have come from South Africa, from France, from Germany, from east bloc countries, Russia, where there is true data, good

stuff?

MR. BAJOREK: I don't think we would necessarily discount them. But our priority right now is to make use of things either we have, or the U.S. codes where there has been a lot of development.

MEMBER SKILLMAN: Is there any prohibition on using foreign information?

MR. BAJOREK: I don't think there's no prohibition. But, gaining access to them and obtaining those codes might be a problem.

MEMBER SKILLMAN: But wouldn't the burden be on the applicant to say here is the code that we intend to use. And here is the basis for its use. And here is our verification of the adequacy of this code?

MS. CUBBAGE: Yes. And if it relied on international data, then that would be -- I think -- I think he was asked -- you were talking about us relying on for our --

MR. BAJOREK: Also the applicant.

MEMBER SKILLMAN: Your willingness to use foreign codes --

MS. CUBBAGE: For our confirmatory or for the applicant?

MEMBER SKILLMAN: No. Your willingness to accept the results of foreign codes if those codes are vetted.

MS. CUBBAGE: They would have to meet all the same requirements whether they're domestic or international. It wouldn't matter.

MEMBER SKILLMAN: Okay.

MR. BAJOREK: It would be the same. And we looked at that. We're not really aware of a whole lot of codes that we would right off the bat consider and find acceptable.

We've looked at a couple of the Japanese codes. But basically they're the same tools that Argonne had developed and used. And Argonne thinks they have better tools for those right now.

So, that's not something we would certainly rule out. But the point of the bullet, that second one under the second bullet is that we're trying to think out of the box.

We're not going to say we're going to have to absolutely develop our own code or take an existing tool and modify it for some of these other reactor designs. We're looking closely at work that's gone on in CASL and NEAMS.

Argonne has done a lot of work for sodium reactor fuels. Also applicable is I understand is the lead bismuth type of coolants as well.

So, we're looking at those. And actually to get to, what I think somebody's question was, well what happens if you had to do it right away? Okay, and you don't have enough time to do that development as you would usually do.

Yes, we might go and actually pick up some of these tools which are available. Okay? Insisting that they do stay with the same quality standards we would have.

They would still have to be assessed. They would still have to be exercised. They would still have to have the right numerics. They'd have to have the right documentation.

But we're not objecting to doing that. And as I think you'll see in another couple of slides, we're gravitating to actually from picking a couple of these tools up for our use if we can gain access, and if the tool passes some of the criteria that we're actually in the process of laying out right now.

MEMBER SKILLMAN: Thank you. That's

good. Thanks.

MR. BAJOREK: We talked about gaps. And I think Dr. Corradini brought that up. And maybe it's good to say hey, there's two types of gaps.

There's the regulatory gaps. There's the technical gaps. And that's really what I'm looking at.

And I see that dropping out of the first bullet and the third bullet. We're going to do this pre-PIRT exercise, identify issue, look at scenarios in a more generic sense.

We expect to follow that up. It might be a couple of years hence. Once the applicant comes in and says here's my design and we hear from Strategy 3 is here's what the licensing basis events or should be.

We would revisit that PIRT for that specific design. Go through that part of the exercise again. And then reexamine the code applicability.

As we're looking at the codes right now, we're looking at a series of -- or a set of codes. Because we see a lot of tighter coupling between neutronics, fuels, perhaps even chemistry

and thermal fluids.

But we need to look at these as a set with the idea of well, what serves the agency best in the short term and in the long term? If we had to pick up another tool, can we use that right away?

If we're going to do something in the long term, is this something that this set or this suite of tools can be used by a relatively small staff? We'd like to try to avoid the situation where we have to have experts in A, B, C, or D different types of code suites.

Because we don't expect to have an increase in resources sufficient to cover that situation. So if we can get to a code set that helps more than one reactor type, that's a benefit for us right now.

So anyway, our initial effort is to start the PIRT process, use that then to identify the experimental needs. And I can almost guarantee you that the -- that overly optimistic slide I had a couple -- up there that prompted a lot of conversation, it probably won't be that optimistic once we get to bullet number three.

Because that's the thing that's going

to have to identify what you're going to have to use to assess the code. Who's going to have to develop that data?

We're going to look for the applicant to provide the vast majority of that. We may supplement that. We may do some of our own tests if it means developing rules or regulatory criteria. But that's generally where we would want to limit that.

We would expect that list to be fairly significant. Okay? And in demonstrating that there's significant margin, that's the gap that's going to likely exist here.

CHAIRMAN BLEY: Through your meetings with the various stakeholders and discussions with them, do they understand that? Or do they have a picture that might be similar to yours as to what it might mean to have to develop that data?

MR. BAJOREK: To varying degrees. I think some of them realize they need to get to a prototype, an experi -- an integral type test facility that develops the data.

Others don't. Some have the approach or they have the thinking that well, we can analyze our way around everything. We have these wonderful

tools from CASL and NEAMS and we're just going to pick those up and use those.

Assessment and validation of those tools is still an open question. Most of those tools have looked at steady state type of situations. They do a fantastic job of looking at 3D code -- core maps and temperature distribution.

But they really haven't gone to things like LOCA or loss of flow or uncontrolled rod withdrawal. Or any of the types of things you might have in a transient situation. Which is near and dear to us in safety.

But not necessarily the most important thing to somebody who's designing a normally operating core. There's a little bit of a difference on there.

The other thing that I sort of detect from some of the very new applicants is -- or potential applicants is that they don't have the idea of the concept of an evaluation model like the more traditional fuel vendor is doing. Okay?

And that I assess my -- I have to define my codes. It becomes my code and my analysis. I'm responsible for the assessment. I'm responsible for the background and QA of that

document. And I need to license that with NRO or NRR.

The idea of just simply picking up a tool that's out there, even if it's something like a RELAP or a COBRA, I think you'll find that that's not something that they really want the staff demands for licensing of a tool are stringent.

They may also want to recognize that in general you don't pick up a tool that's publically available because you're going to want to make your own twists, put your own features on there. Make it proprietary.

That's why you would have an SRELAP, we'll see an NRELAP. We had a COBRATRAC and we immediately put a W in front of it, okay? To keep it proprietary, license that tool.

But then use it for your economic advantage as you move forward. I'm not sure that the pre-applicants appreciate the difficulty in doing that.

MEMBER CORRADINI: So, let me get back to the process. So, 1 and 3 you identified as what you've called a technical reactor analysis.

That's going to be done using some conceptual gas, sodium and other to identify what

might be the technical gaps? Or are you going to wait until a potential applicant comes in and you start having the pre-application conferences with them?

MR. BAJOREK: We're going to try to do it generically for sodium fast reactors.

MEMBER CORRADINI: But there's already a gap analysis. There's an extensive one that was done by some laboratory that will remain nameless.

MR. BAJOREK: Somebody down near Mexico. Someone around there.

MEMBER POWERS: It was brilliant and comprehensive.

MR. BAJOREK: And that type of information --

MEMBER CORRADINI: Is that like Ivanka Trump clothing?

MR. BAJOREK: And that will actually -- that will speed us along. Okay? That will speed us along in that part of the gap analysis.

I think where the more difficult area is going to be for coolant salts, molten salt reactors where the fuel is fixed. And perhaps the most difficult are going to be when fuel salt, molten salt reactors where the fissile material is

moving around with the coolant.

That's where we likely are going to see more of a -- more difficulty in this gap analysis.

MEMBER CORRADINI: So the thinking process is for 1 and 3 with the technical gap analysis, you'd rely on what was done by NRC back ten years ago for the NGNP.

MR. BAJOREK: Yes.

MEMBER CORRADINI: And what maybe, I don't know how long ago it was, but similarly for the sodium one.

MR. BAJOREK: Yes. There's a lot of information out there now. Part of the staff's problem is getting that.

MEMBER CORRADINI: Okay.

MR. BAJOREK: Bring that into this light water centric world that we've been living in.

MEMBER CORRADINI: Okay. And then the second part of my question would be, so let's say you've done that. And then you're -- you have those two for the sodium and the gas, and you're going to do something for the NSR.

Then it seems to me from a process standpoint, if a pre-application conference comes

in with a particular company, are you going to ask them what's high on their list versus what's on your list? Because if you fund this, you'll know that this worry -- this is a concern, that's a concern, this concern, and look at what they're looking at?

MR. BAJOREK: We would expect to do an independent part. I mean, they should be doing theirs. We'll likely do one very similar. And then hopefully we agree.

MEMBER CORRADINI: Okay. Thank you.

MR. BAJOREK: Okay.

MS. CUBBAGE: And Dennis, you had asked, do the Applicants know this regarding bullet three? We're doing our best to get that word out.

At the upcoming workshop, Steve's going to be making a presentation specifically on what applicants are responsible for for validating codes. And he attended the EPRI DOE GAIN modeling and simulation workshop. Where I think the advanced reactor community was well represented there.

And he's explaining all this. So, we're trying to get that word out. It's very important.

MEMBER CORRADINI: Yes. Thank you.

MR. BAJOREK: And then the final bullet, our initial efforts' material's experts getting involved in the codes and standards activities as they apply to some of the materials that they're looking towards for these new reactors.

Just to show a little bit where our thinking is in terms of the code suites that we're thinking about. Here's one that we're looking at for sodium fast reactors.

We might be able to -- well, actually I labeled this one as option two. Because option one is to go and use the Argonne tools. The SASI, SAM as they're developing the tools that they have developed for sodium fast reactors. That's one option.

If we need to go to an alternative, okay? We might be able to use TRACE. Some of our international collaborators from our CAMP program have been very interested in sodium fast reactors for some time.

They've actually put sodium properties and some of the sodium models into TRACE at this point. And have tested some of that out.

But where we're looking towards NEAMS and CASL and outside of the NRC, maybe in the area of the fuel performance code. We're looking closely at using BISON. Especially when you start to look at TRISO fuel. Or you're looking at fuel designs which are not cylindrical in geometry.

The FRAPCON and FRAPTRAN codes are strictly for those types of geometries. We have a long term plan in order to go to a more finite element. Not that it didn't would allow it to use different types of geometries. But BISON can do that right now.

And I think we've even seen some calculations for one of the upcoming applicants where they have used BISON to try to simulate some of the -- their fuel.

So this is an area we may, if we have to do it very quickly, we might be able to use this tool. CTF is the later name now for COBRA.

As we look at conditions in subchannels, we need to look at blockage events. CTF is one we would look at. They have also put sodium properties in this.

So, the idea is here, let's look at some capabilities that are out there. We think we

can link these together possibly with our existing tools using the MOOSE frame work that has been used with NEAMS and CASL.

It's a way of efficiently getting our tools involved with some of the other ones. And getting us to a capability in the near term, hopefully without sinking a whole lot of resources into that.

MEMBER CORRADINI: I have a -- maybe I just -- maybe I don't know what CTF is. Is that just COBRATF?

MR. BAJOREK: It used to be. Yes. Yes, a COBRATF.

MEMBER CORRADINI: Okay. Fine. Just renamed.

MR. BAJOREK: They've renamed it. They've modernized the coding.

MEMBER CORRADINI: Okay.

MEMBER REMPE: So, I have a question about BISON. In the LWR world they had something called MARMOT that was like this micro-scaled thing for which there was zippo data to validate those models.

Now, I thought they were putting perfume in for BISON for the pebble bed. And I'm

not sure how much data there are. But is it going to be like a limited set of models in BISON that you would consider? Is that what you're going to do?

MR. BAJOREK: Probably. Actually the way they're headed with BISON right now is approaching it more like we've done with FRAPCON. They're using experimental information to develop things for fission gas release and creep and swell and all of those things which are fun for fuel performance.

MARMOT I think was a very good academic idea to try to predict those things academically. But as I understand it, the NEAMS and CASL developers are going more traditional in the idea of using experimental data they've been getting out of some of the test programs.

MEMBER REMPE: And only validating it over the conditions for which there are data, and et cetera, et cetera.

MR. BAJOREK: Yes. And that's --

MEMBER REMPE: First principals, predictions and others.

MR. BAJOREK: And that's what's going to be very important for us. Is as we look at the

fuel, where has it been validated? And what are those -- what is degradation mechanisms? And are they reflected appropriately in BISON?

Just another example on what we're thinking about for codes, the more difficult problem is that of a salt fuel, a molten salt reactor. This one we think is going to be more interesting.

Our thinking right now might be to sue a CFD type of code to look at regions of the core where you do not have a lot of structures in a code like a TRACE where a RELAP really is not applicable. We would be able to use TRACE to do the loops and the heat exchangers and other parts of the vessel in the system effectively well.

But maybe not necessarily rely on it for the core. Which is going to have to be very closely coupled with a reactor kinetics tool.

PROTEUS is one that has been developed actually, I think, by Argonne. They have used it for a fuel salt analysis. It's promising. So, we'll consider that.

What gets kind of interesting here is now you have system chemistry effects. All of these molten salts are really a eutectic of two or

three different salts. As you process the fuel, you process the system. You start to get actinides. The chemistry changes over times.

And our thoughts were, we're going to need something in there to help us keep track of what that chemical environment is. Because then that's going to have to feed something that will tell us the cross actions that are going on in the reactor, kinetics tool.

What goes into those boxes, we'd like to try to stay with tools that we've either developed ourselves, or things that have been developed by the National Labs.

System chemistry, when we talked about that at the modeling and simulation workshop, I think everyone sort of had the deer in the headlights look as to what needs to be done there.

MEMBER MARCH-LEUBA: Why didn't you consider using PARCS? I mean, I know you're thinking fuel, solid fuel and everything. But PARCS really takes a six-inch cube and you get what a cross section is even in some conditions.

MR. BAJOREK: PARCS, is a -- PARCS is likely going to be the one that we're going to use for sodium fast reactors.

MEMBER MARCH-LEUBA: How about for liquid -- no, no, for liquid fuel?

MR. BAJOREK: Liquid fuel, it's --

MEMBER MARCH-LEUBA: PARCS only cares what is a cross section in the six-inch cube given the temperature of the fuel and the coolant.

MR. BAJOREK: And that's a question we have for our kinetics experts right now. What name should go in that box.

MEMBER MARCH-LEUBA: It will help on the resource allocation and cost if you keep the same goal.

MR. BAJOREK: Oh, yes. That's very important. If we could stay with a tool and use it for multiple types of systems that makes it easier. Because we --

MEMBER MARCH-LEUBA: I don't see a reason why PARCS wouldn't work on a molten salt fuel. No, no. It's absolutely none there. There's no reason why it wouldn't.

You have to trick -- the way you define the fuel elements on the cross section would be different, but.

MR. BAJOREK: I'm not objecting to it. If PARCS is the tool based on accuracy, efficiency,

cost and schedule, I'm putting my -- I'm reading my instructions that we had for our fuel -- our group.

If it comes to the top, then that's certainly --

MEMBER MARCH-LEUBA: Well, I got the new one.

MR. BAJOREK: But we don't want to at this point, rule out any of the other tools. We're going to look at them.

MEMBER CORRADINI: I want to go onto Strategy 3 which I was going to do. But I can't help myself any more than say that it strikes me, hand calculations maybe was assisted by some sort of MATLAB or Mathematica or something. There might be a way to do this other than this.

In other words, a lot of the systems analysis was begun with a relatively straightforward analysis so that you get a feeling for how these things behave. Kind of back to Dr. Power's point that if you get invested too much in the tool, you start trusting the tool a bit too much.

That's -- and this comes back to your Strategy 1 relative to training. It seems to me I'm not going to train people by telling them go

put this input into the computer and get it spewed back out at you.

Rather do some hand calculations that give you some feeling as to how the system behaves in an integral sense.

MEMBER MARCH-LEUBA: Well, molten salts are such molasses that CFD -- CFD is done to follow all the areas in every single. In that case probably a hand calculation would give you a pretty good --

MR. BAJOREK: I love that --

MEMBER MARCH-LEUBA: It doesn't need to be a hand calculation. It can be done by the computer.

MR. BAJOREK: I love hand calculations. That's the way I scare the code developers.

MEMBER MARCH-LEUBA: You can throw lots of money at CFD.

MR. BAJOREK: I agree. Okay. Just to summarize Strategy 2. We've put our initial plan together and we're starting into this now.

We're considering the various tools. We're entering into a project where we'll look at the PIRT, the phenomena, trying to identify what are going to be the real tough nuts to crack in

each one of these systems.

We do have some limits. Funding does kind of limit, and probably more so the availability of staff. The same people that would be looking at fuels performance in the BISON code, they're also being asked to help review the new scale design.

They're looking at plant up rates. They're also looking into accident tolerant fuel. So, and in some cases we're pulled in several different directions.

Familiarization with the designs is one of those first steps. We need to learn more about the operating conditions, the designs of each of these various systems before we can really, really make firm and permanent decisions on some of these.

So, as we come out of fiscal year '17, my goal at least for the code development part of this is to try to come up with a preliminary set. It will be written in pencil. Okay?

And we think this is what our direction is going to be. There will still be some questions to answer at that point. But as the designs mature, and as we mature, we'll make changes as necessary. Okay?

MS. CUBBAGE: So just a time check before Bill gets started. We have about a half hour before the scheduled break to get through Strategy 3 and 5.

I know you have some people that aren't going to make it this afternoon who were planning to speak. Do you want us to split and go over the lunch?

CHAIRMAN BLEY: I do. We -- you have hardly any slides for 3 and 5 by comparison. Kind of like the report.

MS. CUBBAGE: Yes.

CHAIRMAN BLEY: But we'll probably delve deeply. We have to quit at noon for our own --

MS. CUBBAGE: Yes.

CHAIRMAN BLEY: Separate meeting.

MS. CUBBAGE: Right.

CHAIRMAN BLEY: And we'll come back at 1:00 as -- I think it's scheduled to come back at 1:00.

MS. CUBBAGE: We'll get as far as we can.

CHAIRMAN BLEY: And you'll go over --

MS. CUBBAGE: And we can come back

after lunch.

CHAIRMAN BLEY: And we don't have to quit at 4:30. I don't know if all of the people in the afternoon will have enough material to fill up their time. But they might.

But we can keep going past 4:30.

MS. CUBBAGE: All right.

CHAIRMAN BLEY: So, go as far as you can, Bill. And we may slow you down.

MR. RECKLEY: Okay. So, looking at the framework. It was the one Strategy that went across near term, midterm, and long term in that in the long term if we find it necessary or if we're directed by the legislation, we might go into rulemaking to actually do the technology increasing the framework of Part 53 that we've started and stopped at on a couple of different occasions. Next slide.

So Strategy 3 was divided into seven activities. The first three are closely related. And really, have to be looked at kind of together. Although we split them out as different activities.

One is how are we going to reach safety and security in environmental findings? By and large, we do have the criteria.

In the end public health and safety and the safety goal establish a high level framework from which we start and back up to define possible other criteria that we've used.

The next one in number two, we're going to talk about it a little bit, is to determine the construct of the licensing basis events. And we're working, as Amy had mentioned, we're working with stakeholders on that during the current set of public meetings that we're having.

The third one we've talked about also a number of times. Look -- as we go through this, look for possible gaps in either regulations or policies that we may need to resolve.

One item that was --

MEMBER CORRADINI: Can I --

MR. RECKLEY: Sure.

MEMBER CORRADINI: Now that maybe came a will, on number two. So is that going to be a -- not procedure, an approach that would then cross whether it be sodium, gas, and other? But then applied individually?

Do you know what I'm trying to ask?

MR. RECKLEY: Yes. We will have to decide working with stakeholders what we're going

to look at when. The question right now, and it's not clear to me in any case, as to whether the approach that's being proposed is truly generic across the whole spectrum of designs.

Not only technologies, but within each technology you can have reactors that vary, as Amy said, from single digit or ten megawatt sizes all the way up too traditional, you know, hundreds of megawatt plants.

And so to look across that to see if there's one approach. In the end, the goal is to have a generic construct for any of the non-light water reactors.

MEMBER CORRADINI: So we're coming back to 1860?

MR. RECKLEY: Yes. Well, to the goal of 1860.

MEMBER CORRADINI: Okay. Thank you. Because I like that goal.

MR. RECKLEY: Okay.

MEMBER CORRADINI: Okay. And so to the extent that one could do that, that's why I was asking about it process wise. Okay.

MR. RECKLEY: Right. But we may go through some steps getting there that is not at

first totally technology neutral or technology inclusive.

MEMBER CORRADINI: and then maybe we're in 4, and I stopped you, but 4 kind of answered the question similar too over here from one of the members about, I think it was Harold, relative to whether 1 does it in a 50.52 or in a prototype, right?

MR. RECKLEY: Yes. And also, a big emphasis was, how do you interact early in the conceptual design phases with the understanding this time that some of the companies we're dealing with are kind of doing things in parallel.

Funding, in terms of obtaining funding, regulatory interactions, policy interactions, and a kind of incrementally going through and try to do that all at the same time. So early interactions were important to them.

And so I'll talk about that in a little bit more detail.

CHAIRMAN BLEY: Let me sneak another question in. Because I don't know where it belongs in all of this stuff.

We've heard that when NuScale, well they have come in, that the NuScale application

will -- has tried to closely integrate safety and security. I haven't seen anything yet. That could be true for others. I would hope it would be true for others.

Are you considering how you'll deal with that in what you're doing here? Or is it done somewhere else? What's that?

MR. RECKLEY: No. It will be done here. And that's why security is included in the top pull. As a matter of fact, next week we'll issue security design considerations.

CHAIRMAN BLEY: Oh, next week? Okay.

MR. RECKLEY: Yes. Which is a way to bring into the advanced reactor design criteria, security considerations.

And then the other part is, NEI has submitted a white paper. And we're going to start interacting with them in terms of trying to make sure that security is considered by both sides as early in the design process as we can.

Whether from the designer standpoint that you don't design a plant with a whole bunch of things in mind, safety and other factors, and then when you're done, overlay security and have missed some opportunities perhaps to have done it more

efficiently.

And then from the NRC side, to make sure that we're looking at security and also in terms of the reactor sizes and other aspects.

CHAIRMAN BLEY: Okay. Thanks. I'm really glad to hear that. Is the NEI document a public one?

MR. RECKLEY: Yes.

CHAIRMAN BLEY: Okay.

MR. RECKLEY: We'll send it.

CHAIRMAN BLEY: Mike and Maitri, but the NEI and next week when the staff's document comes out, we want to see that too.

MS. CUBBAGE: Right. And this holds, you know, the security design considerations are really stemming from the Commission's advance reactor policy statement was revised to include security to be in early consideration.

MR. RECKLEY: Number five, we are updating guidance on prototype testing. And also looking at research in test reactors as it might apply to non-light water reactor designs.

CHAIRMAN BLEY: In case you might get one?

MR. RECKLEY: In case we might get one.

And looking also at the recent experience on the isotope production side. And just gaining that experience and bringing it to how we might interact with a vendor or the Department of Energy or whoever it might be.

I had mentioned earlier that we are working with individual designers for them to develop licensing project plans. This was actually something that the industry had brought up as a good practice.

And we're just adopting this into our guidance. The importance of them identifying where they are in the process, what they need from us, what kind of interactions we'll have, what kind of outcome will come from those interactions.

And then lastly, number seven is simply to support the longer term efforts. As during the short term to keep in mind that we might do a rulemaking later on. And the next slide.

So Dr. Bley had mentioned how you do this. There's any number of models on design processes and how they characterize early design steps and all the way up through construction, operation, and even decommissioning.

We brought forward that we would try to

use as close as we can, it doesn't work perfectly, but as early as we can, the DOE critical decision process steps in terms of conceptual. Being where decisions are still being made about the design.

And that's where I was going earlier. That if a vendor comes in and says, hey, we're looking at two different approaches to reactivity control. Getting some feedback from the staff as to if there's preferences or benefits. Or if one's acceptable and one's not acceptable. Because that can then feed back into the design process and the business model.

As Amy mentioned earlier, there might be a case where they come in and say, I want to use a particular material. And we'd say, well this is what would be required. The business model may collapse at that point.

And what we've heard from them is in this venture capital model, they would rather get that decision early then to continue through the process. And then have all the regulatory risks come late in the process.

So, one way this is represented in the literature is to kind of bring up some of that regulatory risk to the beginning of the process.

Not let it wait all the way to the end when all the capital has already been sunk.

MEMBER MARCH-LEUBA: In that sense, I had a note to give you a comment later. But let's put it here.

I'm worried a little bit about the finality of pre-decision, or pre-conceptual design issues.

MR. RECKLEY: Right.

MEMBER MARCH-LEUBA: I mean, you -- some reactor contingencies we only need one shut down system because we have some passive features. And you say okay.

If later on you find out that you were wrong, it's almost a backfit to make the changes.

MR. RECKLEY: Not a backfit per say. But it would make it more difficult. And that's why in the roadmap, we try to identify that the applicant needs to identify what outcome they want.

They can come in and give us, you know, the 50-cent argument. And we'll give them the 50-cent answer that it looks okay from what you've said.

And that's worth what you paid for it. Which is, you've got my opinion as a staffer. It's

not reference able in a future submittal.

MEMBER MARCH-LEUBA: But you can see how that is going to work out, right?

MS. CUBBAGE: Right.

MEMBER MARCH-LEUBA: And you tell them it's okay to have only one of these. And then ten years later after it's built --

MR. RECKLEY: If they want us to write it down such that they can reference it in a future application, we have processes for that. And that would be along the lines of a topical report.

They submit it. We write a safety evaluation. ACRS has a shot to review it. Then they get a more formal document that says yes, the NRC did look at this. And gave either approval, or conditional approval, again at the staff level.

The Commission didn't weigh in. Backfit doesn't come into play.

MS. CUBBAGE: Right. And that approval would probably have a multi-page list of, we assume this, we assume this, we assume this, if this changes, if this changes --

MEMBER CORRADINI: Is that like the 65 items on protection systems with the SMR I might be aware of?

MS. CUBBAGE: Maybe.

MEMBER CORRADINI: Okay.

MS. CUBBAGE: But I was thinking of the ESBWR pre-application review where we approved their models. We approved their test program, et cetera. And there's a whole list of, well, if you end up needing reflow, you know, all bets are off.

So there are whole lists of conditions.

MR. RECKLEY: And then I'll take it, you know, that the ultimate step is that we send something all the way from the staff, involving the ACRS, and send it up to the Commission. And it becomes a final agency position.

So we -- it really will depend. And that's part of the licensing plan. And something we'll just have to talk to designers as we go through the process.

And then --

MEMBER CORRADINI: So, let me just -- maybe this is what you're implying. So the yellow is the DOE vernacular.

MR. RECKLEY: Um-hum.

MEMBER CORRADINI: And the black is the NRC vernacular trying to be overlaid.

MR. RECKLEY: This is all DOE.

MEMBER CORRADINI: Oh, is it? Even the black is? Because I was thinking that the equivalent of CD-2 would be essentially a PSAR.

MR. RECKLEY: Yes. That's true. But that's -- but this is not a graph. This is a view we got.

MEMBER CORRADINI: Okay. Excuse me. Excuse me.

MR. RECKLEY: But, what you said is true.

MEMBER CORRADINI: Okay.

MR. RECKLEY: That would be roughly -- CD-2 would basically be where we do the pre-application reviews I would say for the PRISM and MHTGR in the 90's.

MS. CUBBAGE: And then you, if you're in a Part 50 world, you've got to figure out where you're at on the TP.

MEMBER CORRADINI: Yes. That was going to be my next question. But that's fine. But at least you -- and then when you earlier noted -- you used the term not approval, but assessment of a conceptual design. It's back in the CD-1ish?

MR. RECKLEY: Yes.

MEMBER CORRADINI: Okay. Okay. And --

MS. CUBBAGE: And at the pre-conceptual phase we may get somebody coming in with detail in one area.

MEMBER CORRADINI: Which might be a topical report that they would ask for an SER?

MS. CUBBAGE: Maybe.

MEMBER CORRADINI: Okay.

MR. RECKLEY: And the other thing I'll mention is, there's another round of DOE guidance that we can also work with applicants if they choose to use it. And that's the whole technology readiness levels.

Because some work is done and characterized that way, and it aligns roughly to this critical decision process. So, I think there is nine. Or it depends. Whatever.

MEMBER SUNSERI: I'd like to look at Jose's question from the other side of it. So, his question was, you have an issue. You say it's okay. But later on you find out maybe it's not so okay. And you've got something to do.

What about, you know, the case where an issue comes up and you say like well, there's no way we'll ever accept that. And that's the wrong decision. But you don't -- you won't know it's the

wrong decision because the vendor pulls out and they shut down and everything else.

But yet, with further research or effort or whatever, it could have turned out that that would have been an okay conclusion or what have you. What safeguards are there from an overly conservative decision killing a reactor design prematurely? I guess is the way I'd state that question.

MR. RECKLEY: I would tend to think that the way that would play out is during the interactions with a particular designer who's bring forth that question, so they bring forth and say okay, here's our proposal. And again, I'll go back to reactivity control.

Here's our proposal for a reactivity control system. And we look at it and say no. And if that is really going to be critical and ultimately challenge the success, I would hope most of them would simply not take our first no as the final answer.

And they would come back. And those discussions would work. Now, I'll be, you know, if we say no and they say well, all right, we give up, and leave, then that question, there is a bit of a

risk that that position if you will, kind of stays on the book.

MEMBER MARCH-LEUBA: And I wouldn't just say that the most likely scenario you say no, because we don't have sufficient data to justify.

MS. CUBBAGE: Yes. And if you want to go get the data, then yes.

MR. RECKLEY: Right. And that's the other aspect that Amy mentioned. That most of the approvals, the earlier you are in this process, they're going to be -- to the degree we give approvals, they're going to be conditional.

Yes, but contingent on your research program proving that what you just told us was true, or your analysis.

MEMBER MARCH-LEUBA: Alternatively no, contingent on.

MR. RECKLEY: Right. Right.

MS. CUBBAGE: No because.

MEMBER REMPE: To bring up this thing about the quality again, I know you've said well, it's a graded approach. But at some point where they don't have the necessary quality, can you not get yourself into a situation, what if for example in the Transatomic case that they've been drawn the

other way.

And instead of not going critical for very long or at all, they'd gone the other way. And you've made a finding with respect to reactivity control for example.

It just seems like at some point there should be some expectations communicated to these applicants of what the agency antic -- you know, maybe it's a caveat on the part of your conditional approval process saying we assumed you had adequate QA. That you had independent review, et cetera, et cetera in your submittals.

It just seems like it's a very fluid thing. And when we think about even the more mature vendors and some of the things that have happened with certified designs, maybe there should be more QA imposed on folks in developing the design.

MS. CUBBAGE: If they're developing a design, if they're developing what's going to be submitted, they have to be under an Appendix B program.

If they're doing testing that's going to be relied on for the design, if they're doing computer analysis that's going to be relied on for

the design, it doesn't matter whether they're an applicant yet or not. It has to be under Appendix B.

But, in some of these early interactions, they maybe at a very conceptual level. And they're going to get very preliminary feedback from the NRC.

I don't see any other way around that.

MEMBER REMPE: If one could impose a little bit more earlier on. Even recognizing it's not the final design. But it just seems like everybody's spinning their wheels and their venture capital, et cetera for -- and we could end up with some preliminary feedback.

Which again, the Commissioners or ACRS might push back and say no. But, it just seems like if you had some expectations early on that were communicated that you might have a more productive process.

MS. CUBBAGE: We are going to have our QA folks at our upcoming workshop. They're going to be presenting on what the QA requirements are and what we're trying to communicate that.

You know, we are certainly airing on the side of it needs to be quality.

MEMBER REMPE: Well again, the Canadians again, which seems to be touted a lot by some folks, have said, we get a better quality application because we do spot checking on the processes earlier on to ensure they have adequate quality.

MR. RECKLEY: Yes. The -- I would argue that the difference would be where you are on this plot. And even if you're up at the preliminary design process, I think what you're saying would be the expectation that they've had that in place.

But, the earlier you interact when these companies are small, and they don't have an Appendix B program yet, to say we won't talk to you until you get your Appendix B program, I think we would be told that that's not answering the mail.

MEMBER REMPE: I agree with you on that. But is it imposed and understood in the preliminary design process stage they need to have certain aspects of the Appendix B process in place?

I mean, maybe they don't have the full thing, but do they have some -- at some point do you have some minimum requirements like well, it was kind of in a hurry on there.

MR. RECKLEY: I think we would just depend on the review of the -- to catch that.

MEMBER CORRADINI: But I don't -- I guess I'm kind of with them Joy, I think that's requiring things that might be considered, I don't want to use the word out of bounds, but okay. A bit too much.

MEMBER REMPE: But say T&A makes some conclusions that --

MEMBER CORRADINI: I mean, was -- was SHINE require --

MS. CUBBAGE: We're not giving them a license though, I mean.

MEMBER CORRADINI: Was SHINE required to have an Appendix B QA to get the construction permit?

MEMBER REMPE: Were they required to have any?

MEMBER CORRADINI: It would have a process. And the process was reviewed. But whether or not all the pieces fit into the process going into a construction permit, I'm not clear.

I'm just trying to figure out what a CD-2 is. That's why I was asking what the black and the yellow is.

MR. RECKLEY: No, no. Yes.

MEMBER REMPE: But again, a process with certain things that is reviewed. That again, I'm not sure maybe it's already there and you're doing that.

But I haven't seen that documented as clearly as other places. And think about some other examples where even where they were supposed to have but they didn't.

MR. RECKLEY: Yes. Again, I think what we would depend on is the -- that the preliminary interactions at the pre-conceptual or even the conceptual design phases, as you move through assuming they do, to the next stages, then the expectations, the level of detail, the quality requirements, all of that start to come back or don't start, they come into play at that point.

And even if there was an error made earlier on, it would have been caught later in the process. And that would have -- that will have wasted resources. But that is a -- that's the price. The next slide.

So this complicated slide just lays out the fact that designers do have a lot of flexibility on how they're going to interact with

us. And as has been mentioned, they can do Part 50. They can do Part 52. They can do combinations of Part 52 and Part 50.

The --

MEMBER CORRADINI: Where's the prototype map?

MR. RECKLEY: Well, the --

MEMBER CORRADINI: The prototype map or roadway?

MR. RECKLEY: the prototype roadway could most likely come under the Part 50 trail. And it would be conditions added on through the PSAR and FSAR.

MEMBER CORRADINI: In terms of what?

MR. RECKLEY: And the operating documents that go along with that. The technical specification, the license conditions and such.

MEMBER CORRADINI: Okay.

MS. CUBBAGE: Right. And this graph doesn't even cover the RTR route.

MR. RECKLEY: So basically it lays out the major areas. Pre-application assessments, standard design approval, which is a Part 52 process, which can then be referenced if an applicant were to choose to use that in either a

Part 50 or Part 52 application for design certification under 52. Or a construction permit operating license under Part 50.

Really in most of the discussions we're having the focus is on pre-application assessments. And our message is the importance of the big green box on the right side, talking about supporting activities.

These are the meetings, the submittals of white papers, topical reports, the participation in standard development organizations, and so forth. So, that really lays out the -- much of the ground work that a lot of people forget about.

That even for the operating fleet, how much work was done through those vehicles before you ever got a PSAR or a final safety analysis report. It's the topical reports on systems, the topical reports on codes and assessment techniques and so forth.

So, this lays out again, all the different possibilities that a designer has. And how they might interact with us early. And how they get various levels of feedback, be it informal or formal through safety evaluations all the way up to a Commission decision on a particular topic if

it's critical to their decision model.

Next slide.

MEMBER KIRCHNER: Bill, would you in this big box called pre-application assessments, would you put some structure in that? In other words, the danger that I see for the agency is that you're going to have potentially a wide variety of designs, but also, people on the different -- at a different level.

MR. RECKLEY: Yes.

MEMBER KIRCHNER: Say you have a major, you know, past vendor with the LWR fleet coming in, they obviously bring to the table all their experience to date. One therefore would expect a higher level of completeness and such.

Where someone maybe just the outfit you described. It's 12 people. They're not ready to implement Appendix B at this point, et cetera.

But, wouldn't it benefit you and benefit the applicants and take some of the arbitrariness out of this if you had some definition of what is going to be done for the people that don't know your existing processes?

Do you see where I'm going with this?

MR. RECKLEY: I do. And you're exactly

right.

MEMBER KIRCHNER: Let's assume they don't really know what a topical report entails. Okay. So they may go into this exercise as you thinking that wow, they just gave us the green light. I'll run back to my venture capitalist and say the NRC's onboard with this concept and such.

So, what I'm -- I think it benefits both sides that there's some -- there's some guideline, some definition of what a conceptual design is, et cetera, as they go through this exercise and engage you.

So that there aren't, you know, -- so it doesn't appear arbitrary or capricious to some applicant when they really don't understand, you know, all your processes.

MR. RECKLEY: Part of the interaction will be --

MEMBER KIRCHNER: I know you're having these stakeholder meetings and such. But --

MR. RECKLEY: But that's to make sure they do.

MEMBER KIRCHNER: But at some point you have to codify it don't you? And say this is how we're going to run this game.

MR. RECKLEY: Right. And the way we'll plan to --

MEMBER KIRCHNER: Peaceful benefits from the rules. And so does the NRC.

MR. RECKLEY: And the way -- the way we plan to do that is to issue, I mean, it was issued in draft and we're talking to stakeholders during public meeting about this roadmap.

And we'll expand it as the discussions go on. For example, under standard design approval, one topic, or one advantage of the standard design approval under Part 52 is the scope of that rule is defined as being a major portion of the plant that differs from the design certification. Which is essentially the design.

So, the industry is working to come up with a definition and guidance on what is a major portion such that we can enhance the use of the standard design approval process.

MEMBER KIRCHNER: Right.

MR. RECKLEY: So, that will be coming up in the future. But what we're trying to do -- you're going to gavel?

CHAIRMAN BLEY: I'm going to gavel. And we're going to stop here. I want you to come

back to this slide.

MR. RECKLEY: Okay.

CHAIRMAN BLEY: Because I think a number of us have things that branch off of this.

MR. RECKLEY: Okay.

CHAIRMAN BLEY: We'll come back at 1:00. At this point we'll recess until 1:00.

(Whereupon, the above-entitled matter went off the record at 11:59 a.m. and resumed at 1:02 p.m.)

CHAIRMAN BLEY: The meeting will come to order. We are back to you, Bill.

MR. RECKLEY: Okay.

CHAIRMAN BLEY: Oh, and I promised a question if you --

MR. RECKLEY: Yes.

CHAIRMAN BLEY: -- left that slide up. You're going to get to this, but I wanted to jump ahead while this slide was up. A meeting or two or three ago, when we were talking about this stuff, I had asked if the enhanced safety focus review that Lynn Mrowca and that group were working on was part of this, and I thought the answer was no, but now I see it two slides later. Can you link the two together? Or you can do it later when you get to

that slide.

MR. RECKLEY: I will get to that slide, but while I -- while I have this up, are there other questions? I mean, again, the emphasis -- picking up where I left off, the emphasis on this slide is that it provides a lot of flexibility, and that is a problem for some people because if you are looking for a structured process, it can look chaotic. On -- on the other hand, we are faced with a real situation in which, if you go back a slide or two, we are dealing with designers, just the -- the DOE -- yeah, we are faced with designers that might characterize them somewhere between CD-2 and 3, all the way down to CD-0, and the way we interact with those various designers will have to change to reflect the technology readiness levels, or technology maturity, and what those designers want to interact -- want to get from the NRC during interactions.

It for example could be possible that a design -- and this is all just hypothetical, but a design like PRISM might want to say just to keep things in motion, just to keep us interacting with the NRC, we are going to submit something, right? We -- we largely have not had submittals from --

from DEH on PRISM for a few years now, so -- and the same is true for all the advanced reactor designs, so even though they are relatively mature, and in theory could come in with even an application for a formal approval, they might not want to exercise that and come in for one of those support documents.

And so not knowing what people want or -- or are willing to spend of their money or of DOE's money, or the cost share activity of -- of combinations thereof, we just have -- have kind of left it open for -- we will -- you know, we are from Washington. We are here to help. We will --

CHAIRMAN BLEY: That seems an appropriate point to ask my next question. Can you leave that other slide up? Where in all the things you are doing do you plan to help people who don't know these processes understand what the difference is between CD-0 up to CD-4, what is expected at each point and the things Amy said earlier about construction permit is -- was that CD-2, I think? I can't bring everything up here, but that kind of linkage: where are people going to find that?

MR. RECKLEY: We talk about this during the public meetings, the six-week periodic

meetings, at the workshops, the joint DOE/NRC workshops. We will be talking about it at the RIC. We talk about it in actual pre-application discussions with the designers, individual designers, and so basically, any opportunity we have, or any questions that are raised by the designers, we will interact with them and try to -- not only for us to receive information from them, but for us to give information to the designers about our processes and how we can interact with them.

CHAIRMAN BLEY: Okay. Makes sense, but I am not sure why it is not in a document like this one.

MR. RECKLEY: Okay.

MS. CUBBAGE: Well, I was going to say Bill has put out the draft regulatory roadmap, which I have mentioned --

CHAIRMAN BLEY: Ah yes.

MS. CUBBAGE: -- a few times, so that talks about --

CHAIRMAN BLEY: That makes these linkages?

MS. CUBBAGE: Well, it talks about this topic, and also, NEI is working on guidance for

applicants in how they would interact with the NRC, and so some of this will be addressed. Hopefully you will hear some of that this afternoon from --

CHAIRMAN BLEY: That would be nice.

MS. CUBBAGE: -- other stakeholders --

CHAIRMAN BLEY: Okay.

MS. CUBBAGE: -- but if not, the concept would be that they are putting together some guidance on exactly what you're talking about, and then we could potentially roll that in as an appendix to our regulatory review roadmap to have more of a comprehensive picture on how to engage with the NRC at the various stages.

CHAIRMAN BLEY: Okay. Thanks.

MR. SEGALA: And I just want to add too with the -- when Bill mentioned earlier a licensing project plan that the applicant would submit to us, and then we're having a series of discussions with these pre-applicants on the licensing project plan. We don't want to have pre-application activities until we understand what they are trying to get out of it, and they have an understanding of what kind of findings we are going to make, so it is during that process that we're going to have lots of discussions and make it clear, well, this is -- you

know, you're hoping to get a topical report SE, this is what comes along with that, and this is the kind of finding we can make to try to make it clear to them before we start charging them money for the review that they understand what they are getting.

So -- so you kind of have the general guidance. You have the information we have been communicating at all the stakeholder meetings, but then you -- you have the -- the personal interactions that we have, and it can be quite a bit of interactions, with these new vendors, teaching them how to -- to interact with us, how to, you know, identify something as proprietary, how to -- you know, all the interactions that they have to do with us, we are, you know, holding their hand through that process.

CHAIRMAN BLEY: Okay. Thank you.

MS. CUBBAGE: Some of these discussions were in the first version of the vision and strategy document, but since that time, we published the regulatory review roadmap, we had moved further along, and I thought it best to just focus on that product rather than having the vision and strategy be stagnant and get out of date, so some of that was removed, yeah.

MEMBER KIRCHNER: I would -- would you back up one slide --

MS. CUBBAGE: Whoops --

MEMBER KIRCHNER: -- please?

MS. CUBBAGE: -- trying.

MEMBER KIRCHNER: So I come out of the DOE lab system. I know this process very well. I would not use this here. I think you will just confuse people. There are specific requirements with each block along the line that will be a lot different than what a would-be applicant testing a new concept with you will be prepared to present, and this -- I don't know if they will go look at DOE Order 413 or not and read all the details of this process, and I -- I think it may be confusing to them.

MR. RECKLEY: That is a -- it is a good point. Again, we looked at a variety of models that are available in textbooks and other government agencies and so forth. I will mention, the only thing we are pulling forward out of the DOE order is basically this terminology. This -- they use the order in this process for funding decisions and -- and so forth.

MEMBER KIRCHNER: That is right.

MR. RECKLEY: I mean, that is the critical decision, is whether -- whether to go forward with a project and the various phases of funding. That obviously is not really applicable to this --

MEMBER KIRCHNER: Like --

MR. RECKLEY: -- this.

MEMBER KIRCHNER: -- CD-0 to kick it off is a mission need statement.

MR. RECKLEY: Right.

MEMBER KIRCHNER: Your would-be applicants are not going to come in with something --

MR. RECKLEY: And we --

MEMBER KIRCHNER: -- that looks --

MR. RECKLEY: -- are not --

MEMBER KIRCHNER: -- anything like that.

MR. RECKLEY: -- really -- that is right, and we are not really, in the guidance that we are preparing, using the CD terminology. We are using primarily the pre-conceptual, conceptual, preliminary, final, just -- just as a flow chart process.

MEMBER KIRCHNER: So again, I --

MR. RECKLEY: Okay.

MEMBER KIRCHNER: -- just would encourage in this reg roadmap that these terms are defined, and that people understand what they are getting, because I have also spent the last 15 years following things on the Hill and watching the interaction of the industry and the Congress, and one could be led to believe that if it were not for the NRC, all these concepts would just sail right along, and I don't think that is accurate.

So if someone starts going through your system and does not understand what you're giving them precisely --

MR. RECKLEY: Right.

MEMBER KIRCHNER: -- then they may go to their congressman, which is usually the first phone call, not the NRC, but the Congress, and complain that this is an arbitrary and capricious system that the NRC is running. So I just think for both sides, it begs for more clarity and definition, and again, I think this is notionally kind of what you want to do, but I wouldn't hold that up as a roadmap because if they do read 413, they are going to go, wow, this is -- this is not what I was anticipating at all.

CHAIRMAN BLEY: That is kind of where I was coming from.

MR. RECKLEY: Okay.

MEMBER CORRADINI: But just to clarify, so this is just as -- as you say, notional, but the next slide, where we were, that literally is a pictorial summary of the roadmap, and that is --

MR. RECKLEY: It is, and on the -- and on the right side, it is hard to read. You can see part of the difficulty is that that is roughly the design stage, and you can see that we would be interacting in the final design stages through various possible regulatory processes, and the same is true under the -- the pre-conceptual is a little easier. We would only be doing pre-application discussions during the conceptual design phase.

MEMBER CORRADINI: Okay.

MR. RECKLEY: So --

MEMBER CORRADINI: But I -- I guess -- okay. At least the way I thought about it when I was reading this part of the IAP Volume 2 --

MR. RECKLEY: Right.

MEMBER CORRADINI: -- Strategy 3 point et cetera, this cartoon, it was not as complicated in the -- this cartoon is the roadmap.

MR. RECKLEY: Right.

MEMBER CORRADINI: Okay.

MR. RECKLEY: It is.

MEMBER CORRADINI: And the previous cartoon, which you don't have to go back to, is mainly notional.

MR. RECKLEY: Yes.

MEMBER CORRADINI: Okay.

MEMBER RAY: Is this characterized as an alternative to quote "stepwise," or is this a way of implementing a stepwise regulatory process?

MR. RECKLEY: We would say the latter. This is -- the difficulty is that if you have in your head a logical stepwise starting from pre-conceptual all the way through, you can do that through this process and use these various tools. The difficulty comes in that some applicants, because they are far enough along, would not need the -- there's different starting points for different applicants.

MEMBER RAY: Well Walt mentioned a dialogue that goes on in other places, and the stepwise that I perceive being presented there is first we approve this, then we approve that, but you don't go back and reconsider --

MR. RECKLEY: Right.

MEMBER RAY: -- step one. You did that, and that is -- I take that to the bank, and then step two, I get that done, and I take that to the bank, and --

MR. RECKLEY: Right.

MEMBER RAY: -- on and on, and that of course is I guess what I am concerned that we would wind up doing, is basically issuing a DCD on a stepwise basis. We would have 10 increments to the DCD, and when you got the tenth one, you had the whole thing, but when you got five, you had half of it, and that is the thing that -- that is the image that is concerning to some of us, I know, that -- that is being -- is in some people's mind, or at least apparently is, and which would be very concerning.

MR. RECKLEY: Yes. I am not -- I am not convinced that that can be done because of the interrelationships between --

MEMBER RAY: I am --

MR. RECKLEY: -- the parts.

MEMBER RAY: -- convinced it can't be done, Bill, so let's just begin there.

MR. RECKLEY: Okay.

MEMBER RAY: If that is -- if anybody thinks that can be done, we ought to talk about it.

MR. RECKLEY: But -- but the way we are using the term "stepwise" is that a designer can walk through -- and again, they can -- they can start from different maturities, but in any case, they could step through and get some comfort in a pre-application review, and we would issue a document like we did for MHTGR and PRISM, and say for a pre-application safety evaluation.

Then with that comfort, they could then go maybe to the next step if they wanted to exercise the standard design approval, which is a formal application and a formal document with a safety evaluation, ACRS review, and so forth, that they can then use that as a reference in either an FSAR -- so that -- they build it that way, stepwise, but not --

MEMBER RAY: Those are steps too.

MR. RECKLEY: Yes, different steps.

MEMBER RAY: Different steps, and I just want to make sure it is -- it is what you're talking about --

MR. RECKLEY: Right.

MEMBER RAY: -- and not something else.

MR. RECKLEY: Okay.

MS. CUBBAGE: But what you were talking about is sending in parts? That could also be all part of a standard design approval where they could submit portions of a design and get approval for those, and then submit other portions, but we're in discussions to figure out what does a major portion mean? Bill mentioned that earlier. Does it mean you have to have enough of a design to be able to make a meaningful conclusion?

MEMBER RAY: Well, I mean --

CHAIRMAN BLEY: The problem though is the one Bill hit on, and we saw it in the design certs. Almost any way you cut it, there are linkages that either won't get picked up or will cause problems later.

MS. CUBBAGE: Yes. We fully appreciate that.

MEMBER RAY: Yes. That is -- if somebody thinks we can do it the way I just heard you express, which is fully approve a portion --

MR. RECKLEY: Okay.

MEMBER RAY: -- then I -- I think that requires more discussion.

MR. SEGALA: And I think the way maybe

it might be done, if they submit, you know, whatever, Chapter 15 and Chapter 4, several chapters together of an application, we review that, write an SE that is conditional on certain things, and then we review other chapters, write a conditional SE, and then when all the chapters are done, we then consolidate that all and write a final SER packaging the whole thing together.

MEMBER RAY: I know. We talk about that down at Forrestal, but the problem is the conditions are just so lengthy that it is -- it becomes problematic in the political realm, it seems to me.

MR. RECKLEY: And we will talk -- that is two more slides, we will address this topic again.

One of the things that we brought out, and unless we hear otherwise, is that at least at a chapter level, we are going to basically organize things the same way they have traditionally been -- been organized. So these are just the 19 chapters of an FSAR, if you're familiar with other aspects of designs, applications for either design certifications, operating licenses, or other formal approvals.

So we are going to organize it this way with the understanding that for many of these designs, once you get below the actual chapter heading, it won't look very much like a light water reactor FSAR because the design is different enough that even the next level down after the chapter starts to differ enough that you won't have it, and therefore, the standard review plan and all of the other material that we typically rely on for light water reactor review will not be applicable. So --

MEMBER KIRCHNER: Can we test that, Bill? Let's test it. Let's pick one: Chapter --

MR. RECKLEY: And --

MEMBER KIRCHNER: -- 4. Pick Chapter 4, no, just --

MR. RECKLEY: Yes, okay.

MEMBER KIRCHNER: -- take it. It's going to be so different that you wouldn't do what you would do -- it would be so different that it wouldn't be like the LWR. In what way?

MR. RECKLEY: I am only saying the way the information is -- is organized. In Chapter 4, it actually does hold in that it is organized by fuel --

MEMBER KIRCHNER: Yes.

MR. RECKLEY: -- and reactivity control systems and so forth, but one level below that, they will -- they will start to differ because the fuel is going to be a different form, there won't be cladding, for some designs the reactivity control might be different --

MEMBER KIRCHNER: Yes.

MR. RECKLEY: -- so we will take it as far as the similarity goes, but we're not going to force-fit the technology into the format.

MEMBER KIRCHNER: Okay.

MR. RECKLEY: So we will start to develop.

Now, the other one topic I wanted to --

MEMBER KIRCHNER: I would --

MR. RECKLEY: -- mention --

MEMBER KIRCHNER: -- just submit that it won't be that different.

MS. CUBBAGE: The underlying --

MEMBER KIRCHNER: I have been this -- I have been down this path with you --

MR. RECKLEY: No, it won't be that different.

MEMBER KIRCHNER: -- for the MHTGR and for PRISM.

MR. RECKLEY: And they will organize this --

MEMBER KIRCHNER: Very similar.

MR. RECKLEY: They will organize this way. We were only trying to get this past us because there was a decision point to be made. I mean, it is not too late, but we are -- basically, unless we hear otherwise, we are going to continue with this format.

If we were going to organize the information a different way, now is the time to make that decision, and -- and the -- the easiest way to think about it is if you were going to go into the IAEA safety guides, they are organized slightly differently in the way they -- it is the same information, it is just organized slightly differently. If you wanted to go that approach, we are just asking tell us now. Otherwise, are going to start to develop the guidance using this.

I don't want to make too big a deal out of this because it is just basically whether it is sliced or diced, and how it is organized. It is --

MEMBER KIRCHNER: I don't --

MR. RECKLEY: -- the same --

MEMBER KIRCHNER: -- either, Bill, but

I wanted to take up the next topic, then, which is the standard review plan. And there -- now -- and I understand the criteria now where you are going to be looking at different design criteria, et cetera. All I would like to emphasize, though, is that having that injects predictability in the review on both sides.

So is there -- is there an assumption that there will be a standard review plan adapted for each technology type, or for generic advanced -- non-LWR advanced reactor, or what is your thinking about that?

MR. RECKLEY: Let me get to the -- to the next slide.

The only last point I wanted to make on this slide was that what we are basically offering in the yellow there is that if a -- in the pre-application phase, if an applicant wants to give us basically an FSAR, we can do a preliminary design assessment similar to what we did for the -- in the 1990s, and we can do that complete kind of an evaluation.

What we are also saying, though, is, as I mentioned earlier, there may be critical design aspects that are going to determine the feasibility

of a design, and if that's identified early on, we can address any sub-part of these -- this structure to get to that decision that a designer needs to make. So it may not make a lot of sense for them to look at power conversion and possibly even instrumentation and control if the critical issue is the fuel, for example.

So Amy, if you can go to the next one, we will pick up on the standard review plan and discussions. What we are going to try to do is we will use the guidance as it exists, but we -- with the -- with the understanding that it was written for light water reactors, and, again, in many cases, you are going to run into the case where the applicability starts to fall apart almost from the beginning.

MS. CUBBAGE: I will give you an example. I just pulled up SRP Chapter 4, 4.5.1, Control Drive Structural Materials. Do you have control rods? I mean, you start to pretty much get really far away from the SRP once you go down a level.

MR. RECKLEY: So -- but what we will take, and this is where we are looking at the safety-focused review effort as it was developed

for NuScale, using it as an evolutionary step, but really taking it to the next up. And the question is will we develop a standard review plan? Not until we have a need for a standard review plan. And the reason I say that is --

MEMBER CORRADINI: Repeat that since that sounded like doublespeak.

MR. RECKLEY: Well, it is doublespeak because when you're dealing with -- when you're dealing with an applicant for a design and a technology, you need a review plan. But the standard review plan can be dropped. The standard review plan implies something you are using because you have a multitude, and you can apply a standard in order to get consistency.

So we will have a review plan for each design and technology. As we feel the need, it might evolve into a standard review plan if the numbers justify that we need a standard, but in the meantime, the considerations that are incorporated into the safety-focused review for SMRs will be applied as we look at each chapter and each sub-chapter in describing the design. What is the safety significance of this, you know? And we can look at, you know, the key, is it -- is it

supporting reactivity control, heat removal, or the -- limiting the release of radioactive materials? I mean, those are the three critical safety functions.

How is it addressing one of those three critical safety functions? If it is not or does not have an impact on them, maybe on the secondary side, for example, do we need to look at it? How much information do we need? So we will -- we will use this structure as it has been developed: safety significance, compliance, the degree to which it has been tested if it's a novel design, and so forth.

Operational programs, we talked about that a couple times. This isn't just going to be the design. From the design and from the regulatory reviews and the issuance of licenses and approvals will come constraints on that design, including what surveillances need to be done over the long-term; what are operating limits that if you exceed, you might have to shut down the plant or you might have to do some other corrective action? So this is the kind of thing that we're going to basically be applying as the review tool for each design as we look at each aspect of the

design.

The -- an example that is -- that is often brought up is -- I think Steve mentioned the safety margins and the thermal margins. In discussions, the thermal capacity of these systems -- an advantage, and mentioned in the advanced reactor policy statement and incorporated into these designs, is a larger thermal capacity on the primary side, be that the difference between the temperature of the sodium and its melting point; the existence of large graphite heat sinks within the -- the coolant system; or in the salts, again, the large thermal capacity between the operating temperature and the boiling point of the salt.

Large thermal capacities: those thermal capacities can diminish the importance of the interactions between the primary and the secondary side in terms of secondary side plant upsets. I mean, that is a big thing in light water reactors. You have a secondary side event, it can lead to a fairly rapid pressurization on the primary side, and now you have to have safety functions to address the pressurization of the primary side. That may not exist for some of these designs, and therefore, the importance of the secondary plant

can be greatly diminished from its safety significance and its possible ability to cause a -- a plant transient that is challenging safety systems.

If that is true, then the amount of review that we should do of that secondary side is greatly diminished from what we have historically done for light water reactors, so that is the way this would be used and -- and developed. So with that, I will open it up --

MEMBER SKILLMAN: Bill --

MR. RECKLEY: -- or --

MEMBER SKILLMAN: -- let me ask this: you described in the prior two or three slides a process that has been used and useful. It is well understood by the staff. There are thousands and thousands of pages of documentation that instruct how to -- how to approach Part 50 license or Part 52 license.

Later this afternoon, we are going to hear from a group that is going to tell us you really ought to use the Canadian system, which is a partial license system. Here is my question: in your toil to get to this place, what other countries' licensing systems did you evaluate, and

why did you choose the current Part 50 and the current Part 52 approach as your standard? What other countries' processes did you consider, and why did you end up where you are?

MR. RECKLEY: We looked -- not in detail, so I am not -- I can't give you a document where we did the comparisons, but just from general familiarity with some of the European systems and the Canadian system, I think in large part, the reason we picked what we have now as opposed to going to a -- a different model is because it exists and we have that -- we have that -- that structure.

To the -- to the degree that you go to a -- an approach that is more developed on a safety case where an applicant basically is -- presents a safety case, and we don't have the guidance and the acceptance criteria defined ahead of time as to how that would work, I -- I just have not heard in the interactions with stakeholders a -- a desire for us to go to that --

PARTICIPANT: So --

MR. RECKLEY: -- approach --

PARTICIPANT: -- so --

MR. RECKLEY: -- to be honest --

PARTICIPANT: -- so --

MR. RECKLEY: -- with you.

PARTICIPANT: -- so you are being --

MEMBER SKILLMAN: Did you hear the opposite, an unwillingness to consider other --

MR. RECKLEY: I don't think --

MEMBER SKILLMAN: -- processes?

MR. RECKLEY: -- I don't think we're unwilling.

MEMBER SKILLMAN: I mean from the stakeholders?

MR. RECKLEY: I think --

MS. CUBBAGE: What -- I want to just make sure we're all talking the same thing --

MEMBER SKILLMAN: Okay.

MS. CUBBAGE: -- because you mentioned Part 50 and 52.

MEMBER SKILLMAN: Yes.

MS. CUBBAGE: Are you talking about the Canadian conceptual design review in a pre-application, or are you talking about --

MEMBER SKILLMAN: It's a -- the Canadian process is a six- or seven-step process. It is different fundamentally from --

MS. CUBBAGE: Right, but --

MEMBER SKILLMAN: -- Part 50 --

MS. CUBBAGE: -- what we're --

MEMBER SKILLMAN: -- and 52.

MS. CUBBAGE: -- what we're hearing from stakeholders is not that we should abandon Part 50 and 52. What we're hearing is that at the conceptual stage and the pre-application stage, some stakeholders like the structure of the Canadian model, and what we're saying is we can do that under our existing regulatory framework. We can give that type of feedback to an applicant at the pre-application stage if they provide that level of information, but we also have the flexibilities to engage with applicants if they want to submit different information.

We are trying -- we are trying to accommodate everybody's different business models and situations and not have a one-size-fits-all. Some people want a one-size-fits-all, and I don't know that that is going to be universal.

MR. SEGALA: In the Canadian process, they make a finding of no obvious impediments to licensing in Canada. Well, that is the same finding we made for PRISM in the pre-application safety evaluation report, so we are -- we are just

saying that we think we have the flexibility in the current regulatory framework to basically do what the Canadians are doing within our current framework.

MEMBER CORRADINI: So -- so you must have asked -- I mean, I guess I have a guess of what the answer is. When you ask potential applicants why do they even find some benefit from the Canadian system, what is their -- what is their --

MS. CUBBAGE: Are you going to have to ask the folks that are going to speak to you later this afternoon what they are interested in, but we --

MEMBER CORRADINI: But they must tell you.

MS. CUBBAGE: -- but we know that not everybody shares the same view.

MEMBER CORRADINI: But the -- because when I have spoken with the Executive -- the EDO equivalent, Ramzi Jammal, he says they come to us because they think it's faster, and he says it is not going to be faster.

MR. RECKLEY: The -- the most often-cited thing is the predictability. The Canadians

have given estimates of time and resources to do the various phases of their pre-application review, and we don't have a published estimate of that -- that kind of thing. We have said we will deal with an applicant to come up with that if they come to us, but we don't have a standing this will take about 18 months and cost about -- I forget what it is --

PARTICIPANT: 4000 hours.

MR. RECKLEY: Yes.

MS. CUBBAGE: Right, I mean we --

MR. RECKLEY: Number of hours or millions of dollars, so --

MS. CUBBAGE: We plan to do that on an application-specific basis with the licensing project plans, and based on the design and the outcomes that are desired, then we can give estimates of scheduling and, you know, estimate of cost, but, you know, a one-size-fit-all is kind of difficult for a cost and schedule when you have a range of designs, from very simple single-megawatt designs up to the 1000-megawatt. I mean, a lot of range of complexity there.

MEMBER REMPE: And it also depends on the quality of the application --

MS. CUBBAGE: Absolutely.

(Simultaneous speaking.)

MEMBER REMPE: -- conditional --

MS. CUBBAGE: Yes, so --

(Simultaneous speaking.)

MEMBER REMPE: A lot of times, in the discussions I read in the popular press, they keep talking about the need to modernize the NRC's licensing framework, and what I have heard in your last few slides is basically saying our existing framework can accommodate this. We don't -- I don't see you saying I need to modernize it, and I think your arguments sound solid to me, so have you tried to push back and get some of those comments resolved? Because I am puzzled why they keep saying you need to modernize the --

(Simultaneous speaking.)

MR. SEGALA: I think the comment is that our current regulations were written for light water reactors, and so you -- as you saw in Amy's slides, we had, for the mid- and long-term, we added that strategy to look -- or the contributing activity to look at should we update the regulatory framework or not, and we have that as necessary.

So I think in the near term, the zero

to five years, we are looking at what we can do to be more effective and efficient within our current regulatory framework, and then as a mid- and long-term activity, we are going to look at whether -- whether or not it makes sense to revise the regulatory framework for non-light-water reactors.

MS. CUBBAGE: And part of that frankly is in recognition that rulemaking takes time, and I think if there is going to be any near-term movers, they are -- they would have to wait for a rule -- you know, I don't think they would want to --

MEMBER REMPE: But they --

MS. CUBBAGE: -- wait --

MEMBER REMPE: -- may --

MS. CUBBAGE: -- for a --

MEMBER REMPE: -- want you to --

MS. CUBBAGE: -- rulemaking.

MEMBER REMPE: -- expedite even sooner is what I have --

MS. CUBBAGE: Right.

MEMBER REMPE: -- heard, and so again, I am not sure why they are -- maybe I will ask them why they need to --

MS. CUBBAGE: Right.

MEMBER REMPE: -- modernize it. What

is their vision here to -- to get it vastly, quickly done, and with a modern framework?

MS. CUBBAGE: So the word "modernization" you may have heard in the context of NEI/Southern's initiative. They are calling it the Licensing Modernization Initiative, and you can ask them --

MEMBER REMPE: Yes.

MS. CUBBAGE: -- later what they mean by that, but in the near term, we have a common understanding that that means within the current regulations.

MEMBER REMPE: Okay. Thank you.

MR. RECKLEY: Okay. Next?

So I did want to spend a couple slides on licensing basis, license basis events and the discussion of those that we have underway. It I think has been mentioned by a few of the members. It does form a central element of how we go forward, and it is very hard to imagine how you make some of the decisions until you have at least an idea of how you're going to do this construction.

So before getting into how it might be modernized, I will address at least my

representation of how it is currently constructed for light water reactors, and if -- you know, it is -- it is a complex topic in that we are now, as someone mentioned, 60 years into light water reactors, and I -- we still have a lot of discussions about how this works and how it doesn't work, what it means, and how to apply it. And so one of the things we would hope I think going forward is -- is to start from a better place where things are better-defined.

But just -- just to spend a couple minutes on the current construct, I think one thing that is important to understand is that this evolved over those 50 or 60 years. It did not start off like this, and so it was simpler -- it was simpler in the beginning. Things were more black and white. And over the years, we introduced at least 50 shades of -- of gray.

(Laughter.)

MEMBER CORRADINI: Oh, you must have thought that one through.

(Laughter.)

MS. CUBBAGE: Some have called it a patchwork, in fact.

(Laughter.)

MR. RECKLEY: So anyway, there we go.

So in this -- in this construct, the anticipated operational events and design basis accidents and the siting source term are fit into three kind of analyses that were performed, and part of this was the availability of technology and the way the computer codes worked and the fact that they were not integrated, and the fact -- so that is in part why it is constructed the way it is. And there were a lot of other reasons why it's constructed the way it is. But within the blue area, anticipated operational events, design basis accidents, and the siting source term, that -- that really formed what is called the design basis accident, design basis event realm. Defined what equipment would be safety-related: if you needed the equipment to address any of those things, then that largely met the definition of what needed to be safety-related. It largely defined what had to be in the technical specifications and controlled.

The external events were handled a little differently in that once you identified all those safety systems and critical elements within the plant to address those events, then you had to

protect them against the external events, and that was done largely deterministically: a design basis earthquake, a design basis flood, and you would define what restraints you needed, how high your flood protection needed to be, and et cetera.

MEMBER CORRADINI: When you wrote "external events," I took it as man and not man, not just natural.

MR. RECKLEY: And that would be true too, manmade events for the most part.

MEMBER CORRADINI: Okay.

MR. RECKLEY: Right.

CHAIRMAN BLEY: Just --

MS. CUBBAGE: Manmade --

CHAIRMAN BLEY: -- to interrupt --

MS. CUBBAGE: -- but not --

CHAIRMAN BLEY: -- you a --

MS. CUBBAGE: -- intentional.

CHAIRMAN BLEY: -- second, if you use this slide again, you have a frequency and a consequence scale, and the BDBEs ought not be up in the upper right-hand corner. They ought to be in the lower right-hand corner if you're going to keep those --

MS. CUBBAGE: Well, the concept was

they were add-ons, and they were not necessarily --

CHAIRMAN BLEY: Oh, they were, but --

MS. CUBBAGE: -- done in a --

CHAIRMAN BLEY: -- but if you didn't --

MS. CUBBAGE: -- in a --

(Simultaneous speaking.)

CHAIRMAN BLEY: -- have that frequency, implying there was a frequency relationship there, it would be better.

MS. CUBBAGE: You are right, but the fact that they were added on in response to specific things like station blackout and they were not necessarily done in an explicit --

MR. RECKLEY: Next time --

MS. CUBBAGE: -- risk --

MR. RECKLEY: -- I will --

MS. CUBBAGE: -- consequence --

MR. RECKLEY: -- just leave --

MS. CUBBAGE: -- way --

MR. RECKLEY: -- those arrows off.

CHAIRMAN BLEY: You want the arrows to apply to the L, the blue L and only the blue L, and --

MS. CUBBAGE: Right, right.

CHAIRMAN BLEY: -- an observer of this

slide --

MR. RECKLEY: Yes.

CHAIRMAN BLEY: -- might not --

MR. RECKLEY: Know.

MS. CUBBAGE: Agree with you.

CHAIRMAN BLEY: -- know that's what you meant. Well, they ought to be able to figure it out --

MR. RECKLEY: Yes.

CHAIRMAN BLEY: -- but still.

MR. RECKLEY: And -- and then over time, the beyond design basis events were added, station blackout, and more recently, Japan lessons-learned-oriented mitigating strategies, the B5B, 9/11 mitigating strategies, and so forth. So -- so that is -- is basically the -- the current construct. Go to the -- the next one.

And you see the kind of integration now within the current proposals. This is from the -- the NGNP activity, and even before then, the MHTGR work that was done in the 80s. And basically, you introduce PRA now not as an overlay to see what maybe additional mitigating strategies you need, but you're incorporating it into the design process, and you're using the PRA to help you

design your licensing basis events.

And from the licensing basis events, you are taking a subset to analyze using more traditional means by using conservative assumptions and calling them your design basis accidents on the -- on the graph, where you would only credit safety-related equipment. Again, going back, you could construct it different, but the -- this approach allows you to keep those traditional safety classification of equipment designations and some of the other infrastructure.

MEMBER POWERS: That just will increase the complexity and the --

MR. RECKLEY: It's, in part, I think, due to the fact that this was started and this has been a fairly constant proposal, but it goes all the way back to the 80s. And so keeping that --

MEMBER POWERS: So in your view, we should continue to ride horses and churn our own butter and things like that?

MR. RECKLEY: It is a way, it is a way to do it. And --

MEMBER POWERS: It is a way.

MR. RECKLEY: And 1860 and some other proposals have had other ways to identify what the

special treatment and special requirements on equipment would be.

MEMBER POWERS: Well, let me ask you a serious question. Do we have definitive evidence that all these special treatment requirements actually accomplish anything for us?

MR. RECKLEY: I would say yes. If you look at quality assurance -- I mean, this is a little dated now, so it's a harder question than maybe at first it would appear. If you look at the --

MEMBER POWERS: It was certainly intended to be a very hard question because I'm unaware of evidence that this helps us.

MR. RECKLEY: It depends on from where you start. If you start from before Appendix B and some of the quality assurance issues that plagued not only the nuclear industry but other areas, you would say quality assurance has certainly played a large part in approving the safety of plants. If you get into a more difficult question and start to say, well, that was then, this is now, compare ISO 9000 to Appendix B, it's a harder question.

So this construct is what the burn activity has picked up. It was pulled into NGNP,

and now it's in the licensing modernization technical requirements. Something. I get mixed up on the acronym.

So you have the individual events, some of which would fall into the category of anticipated operational occurrences because they're at frequencies on the order of ten to the minus two and then design basis events, which gets down to ten to the minus five or six. And, again, the design basis accidents that are handled separately and given a special analysis using the more traditional deterministic approach.

So we're looking at these. One of the things on this graph and one of the parts that we're having discussions with is you see the dotted line at one rem. That becomes, under NGNP and other designs, a goal in order to limit the degree of emergency preparedness you need to develop and maintain at whatever distance exceeds one rem. And, normally, we talk about at the fence for most of the facility.

So one of the discussions is how does that, how does that play in, whether it's an after-the-fact, I've designed my plant, I've used the top-level regulatory acceptance criteria, which

would be 25 rem for a design basis event, but my design is good enough that it's showing that one rem can be met. Now I can take advantage of that one rem and get some regulatory relief from that performance in my plant. That's one approach. A subtle difference would be to establish one rem as a design criteria and treat it more like the top-level regulatory criteria, as opposed to a performance goal.

So those kind of discussions are where we are in the process right now.

MEMBER SKILLMAN: Bill, let me jump in here just for a second. To my prior question about other countries' licensing systems, the Germans use what is known as a Teilrechnung. It's a partial erection permit license. It's seven pieces, and the first piece is a petition to the Department of Interior of Bundes Republik for the land, and that has all kinds of political bells, lights, and whistles. That is a big deal.

But once the permit is granted, part two is the establishment of the accident design basis. Part three actually pours concrete and allows the components to be installed, but you can't go to a concrete pour until you've satisfied

the off-site dose issues. Then four, five, six, and seven follow a fairly methodical construction - inspection process.

I lived in that system for a number of years, and I was fully familiar with the Part 50 process before I went to Europe. When I came back, Part 52 was just really getting started. And we had multiple debates, whether the old Part 50 with the two preliminaries and two finals and all of the meetings was the better process than the seven steps in Germany. But what we determined is the thoroughness of the seven steps is extraordinary as long as there was a QA program applied.

To those who say the system needs to be modernized or whatever those words are, I just wonder if there isn't something better, and I think it can be done under the existing 10 CFR 50 with regard to the design of components, Part 100, and all the other pieces that we rely on to ensure that the health and safety of the public is protected.

But it just seems as if we're heading into this new world of new reactors with the question that Joy was posing. What's new? Why isn't there a new process? There may be one that really is better.

I'm just going to leave it at that. I know that system works, and I know it's very successful. Some say it's very costly, others say not so much. It's probably the same as what we have in this country. But if you hadn't looked or no one has looked, you might want to get a sounding on that and say that might be something that is advantageous for the new plants going forward. What it really does is it establishes up-front what your accident requirements are, and I would think that that would be very valuable for the new materials, chemistry, fuels, enrichment, the types of questions that are accompanying those technologies relating to the siting.

MR. SEGALA: One of the things also that seems to be out there is that they want a performance-based risk-informed technology-neutral framework, you know. I don't know if that's what the Germans are doing or not, but that's kind of, that's where they want us to go with this new framework.

MR. RECKLEY: And you can look at this frequency consequence curve. Usually, when you're talking about modernization, you're largely involved in adopting this kind of --

MEMBER SKILLMAN: And that's why I asked the question at this point.

MR. RECKLEY: One more. So also within the discussions is the age-old questions of how do you balance the use of the risk information with more traditional deterministic or engineering analysis approaches. I pulled the graph out of one of the NGNP that shows how these things interrelate and how you have to consider basically all of them. So we're still having those discussions.

I always like this because it shows both, as we've talked a number of times, not only the design, which is the plant capability, but also the programmatic defense-in-depth side. There's an operation side to all of this. We tend to get very focused on design, but equally important is the operational side. And then in the beginning, the deterministic evaluations and risk insights and how they're used together to provide the desired confidence.

The 4S table that I provided was only a personal observation for me. Some of the designs, and particularly maybe some of the simpler designs, the traditional approach of actually doing a deterministic assessment of fission product

barriers might be an easier approach. And if they were to do that, we didn't want to rule it out. And so all this table basically shows is that there's not necessarily a disagreement between these approaches.

If you set up the frequency consequence curve as the highest-level regulatory approach, in general, if you can show that a transient or an accident doesn't challenge a fission product barrier, then there would be no reason to assume that it was going to challenge the frequency consequence curve. And so, again, I wanted to include that just because for some designs they might want to look at it from that aspect, as opposed to developing a more complicated mechanistic source term and carrying things all the way off through an off-site dose calculation.

So I think, with that, we can end and go to policy.

MS. CUBBAGE: Okay. So for the policy issues, I'm not going to go into every one of the issues on the next three slides. I'm going to highlight the ones that we're actively working on. So this list shows many issues that have been gathered over the years that relate to SMRs and/or

non-LWRs. And we've been tracking these. There was a paper in, I think it was 2010 was the one that listed a whole long list of issues that needed to be resolved in readiness for the SMR reviews. And a lot of those are equally applicable to non-LWRs. And at this point, most of them have been resolved for SMRs, but we're looking at them again to make sure there's nothing that needs to be done further for the non-LWRs.

For example, the annual fee issue was resolved for SMRs where the fee rule that has a variable fee structure for smaller light-water designs, that was not applicable to non-LWRs. We would need to re-assess later when we got closer to a non-LWR operating reactor what the regulatory, what the cost of regulating that class of reactors is, and that would go into figuring out what the fees should be. So --

CHAIRMAN BLEY: Before you leave this --

MS. CUBBAGE: Oh, I'm not going to leave it yet. Go ahead.

CHAIRMAN BLEY: I'm looking at the bottom one and the safety focus, have you already written sections of the SRP that include that?

MS. CUBBAGE: So for the use of PRA in the licensing process, we have the SRP Chapter 0, Rev -- what do we call it? Part two or I don't know. There's the SMR section of the SRP --

CHAIRMAN BLEY: Yes, and that was kind of almost blank before just an outline.

MS. CUBBAGE: Yes, it's the introduction to the SRP, introduction part two, and it talks about how we're going to use risk insights in SMRs. And then that led into the DSRSs for mPower and NuScale and has now led into the enhanced safety focus review for NuScale.

CHAIRMAN BLEY: But that one hasn't been documented yet, right? The safety focus review? In any formal --

MS. CUBBAGE: We're implementing it.

MR. RECKLEY: Not to the level of detail, I think, that's been described to you. But that is the --

CHAIRMAN BLEY: We saw the spreadsheet thing, but we haven't seen anything beyond that.

MS. CUBBAGE: That's what you'll see.

CHAIRMAN BLEY: Okay.

MS. CUBBAGE: So, basically, from an SMR perspective, that's being implemented on

NuScale, and that's an area where we're clearly going to be doing more work in the non-LWR arena because that's where we're looking at licensing basis event selection, how PRA is being used to guide what sections of the design we even look at or to the extent we look at it. So that's one that's definitely more to follow for non-LWRs.

CHAIRMAN BLEY: Are you working on the SRP revisions now, or is that --

MS. CUBBAGE: The SRP has already been revised for -- so we have the SRP --

CHAIRMAN BLEY: Okay. I know the one you're talking about. The third case, which is what we're talking about here, not quite complete. It said we'll expand that in the future.

MS. CUBBAGE: Right. When it says SRP revisions, that was relative to LWR, SMR. There are SRPs in place, DSRSs in place, and the safety focus review is ongoing.

So a couple of things that I wanted to point out on this page is that, for prototype reactors, we're drafting a guidance document. It should be available in April, and that will be just, there's no policy issue there, that's just explaining what our current regulatory processes

for prototypes. MEMBER CORRADINI: This is the Part 53 dot, dot, dot, whatever it is.

MS. CUBBAGE: 50.43e.

MEMBER CORRADINI: Thank you very much.

MS. CUBBAGE: Siting. That's been resolved from the perspective of the use of mechanistic source term. There's no policy issue on that front. However, with reduced source terms and reduced siting area, there's another requirement in Part 100 that may come into play where you're supposed to avoid siting near very densely-populated areas.

So we don't have anyone right now that's proposing to be sited near a very densely-populated area. But if that were to happen, we're looking at what that would mean and we're planning to engage stakeholders this year, consistent with what we told the Commission in SECY-16-0012. That could be an issue for non-LWRs who may be wanting to site near facilities to take advantage of process heat applications.

There wasn't anything I wanted to particularly focus on in this one, other than maybe the bottom line there, and that's that defense-in-depth, that's going to be something we're going to

be looking at for advanced reactors, clearly, as part of licensing basis event selection and everything we do.

The next page, we already talked -- yes?

MEMBER SKILLMAN: If I could, please, back to that one. I don't recall our committee reviewing SECY-11-0098. That might have -- well, I don't know whether we did or not, but I would sure like for us to get our oar into that one.

MS. CUBBAGE: Okay. And that was relative to SMRs and, basically, we can get you a copy of that.

MEMBER SKILLMAN: May I ask you?

MS. CUBBAGE: Oh, absolutely. It's on the --

MEMBER CORRADINI: Just because I think I know where Dick is going with this, this was cited when we had the subcommittee meeting relative to -- now I forgot the title of the subcommittee meeting. And staff, in fact I think it was research, Mark Caruso, mentioned that this would have to be brought into a discussion for multi-module. Because it was mentioned, I just don't think staff has decided exactly how this fits.

MS. CUBBAGE: You're talking about the staffing for multi-module?

MEMBER CORRADINI: Yes.

MS. CUBBAGE: Okay. So what we told the Commission is that we would develop guidance. We did that. So we have guidance on how to do a task analysis, etcetera, etcetera, to ultimately determine what is the appropriate staffing for any particular modular reactor. And then, in the near term, if someone wants to propose less staffing than would be required by the 10 CFR requirements, they could do that through the exemption process, but they would have to justify their staffing level based on task analysis and all the human factors evaluations that we already have guidance in place for.

So we're not seeing it as an open policy issue. It's clearly a review issue on NuScale. You have to review what they've decided, you know, what they are using to justify their staffing. I hope that -- and NuScale is doing that, and we would use a similar process for any non-LWR staffing down the road.

Anything else on that?

MEMBER SKILLMAN: Thank you.

MS. CUBBAGE: Okay. So we already discussed a little bit security requirements. From a Strategy 3 perspective, we have the security design considerations that look like GDCs for security, and those have been signed out and will be published in the Federal Register probably next week.

This is talking here about further looking at security. NEI submitted a white paper recently. During the break, I sent it to Maitri. She can distribute that to you all. And this is taking it a step further to look at the specific design, what the consequences are, and having the security be reflective of the potential consequences of the reactor. So instead of a one-size-fits-all, it would be scaling security requirements based on source term and accident consequences.

Aircraft impact. That's one that, you know, it's not an issue, per se, from a policy perspective right now, but we're looking at, you know, for a very small design, potentially if it's embedded, does aircraft impact assessment need to be re-looked at as what we would do in that area.

Then I've listed some of the key

technical and policy issues coming out of NGNP. Licensing basis event selection we've already discussed. We're going to be hearing from Amir on that shortly, and we're engaged with them on that project.

Functional containment performance criteria, that's an issue we hope to take to the Commission in the near term to establish what the performance criteria should be. Fuel qualification, that's going to be technology-specific, but that's an area that we want to spend a lot of time on. We know that's a long lead issue. A lot of work has already been done in the NGNP area, but we have to look at, for the other designs, what does fuel qualification look like, particularly the molten salt brings in some unique issues there.

I mentioned previously fuel cycle issues and enrichment issues. We're having ongoing discussions with stakeholders to figure out are there any regulatory or policy issues we need to deal with in the near term.

And just globally, we're looking to work with stakeholders to, if you see a policy issue that we're not working on, let us know what's

important to you, what decisions do you need to support your business decisions.

And that wraps up the policy issues.

MEMBER KIRCHNER: Amy, may I ask you --

MS. CUBBAGE: Sure.

MEMBER KIRCHNER: Some of these obviously bear on each other in different ways. Let me just pick a couple. PRA in multi-module facilities where you could have common-cause failure, implementation of defense-in-depth and functional containment, and then obviously the siting and evacuation guidelines, they're all interrelated. So is your expectation that you'll just have a SECY as a paper or policy decision, and how do these all get pulled together and --

MS. CUBBAGE: Yes, so there's clearly a close relationship between a lot of these. So for example, the Commission has already approved rulemaking on EP, so scalable EP. That would be contingent on demonstration that the source term supports, so you can kind of look at the EP sort of independently with the assumption that the source term calculations are going to show a certain, justify a certain amount.

So then, separately, you can look at,

well, mechanistic source term, there's no policy issue there. You can use mechanistic source term. And then the issue of siting near densely-populated areas, that's a very specific issue. We're going to go to the Commission with that.

We're aware of all the interrelationships, but we kind of have to tackle the specific issues that need to go to the Commission. To the extent that they arise, we're going to bring them to the Commission.

MEMBER KIRCHNER: And those would likely find their final embodiment in rulemaking or --

MS. CUBBAGE: Some could eventually have rulemaking. So the EP went to rulemaking. The security design, consequence-based security proposal from NEI is proposing rulemaking. So some of these eventually could go to rulemaking.

Okay. So just to wrap up, looking for your feedback on our plans. Next steps after we consider your feedback and stakeholder input, we'll be providing the documents to the Commission later this spring, and we're interested in hearing from you also at what point you want us to come back, what documents you're interested in having more

dialogue on. So we'll be looking to continue to have that dialogue maybe informally as we go to figure out when you want to see us again.

CHAIRMAN BLEY: Okay. And we'll have a session at the end of today's meeting to have a little discussion about tomorrow and what happens after that. Anything more for this? Then I think it's time to switch and we'll go to Jim Kinsey.

MR. KINSEY: So my name is Jim Kinsey. I work with the Idaho National Laboratory. I'm providing you some feedback today on behalf of --

CHAIRMAN BLEY: Green light.

MR. KINSEY: Thank you. My name is Jim Kinsey. I work at the Idaho National Laboratory, and I'm providing you some feedback today on behalf of the Department of Energy. I understand the focus of the discussion or the input I got a couple of weeks ago in preparation for the meeting --

CHAIRMAN BLEY: I'm sorry, Jim. Let me interrupt you. Did we get hard copy slides?

MR. KINSEY: I have the hard copies in the back. The focus of the dialogue of the notes that I've pulled together look at the various connections between programs that DOE either already has in place or is moving toward and how

those connect or align with or maybe, in some cases, not really very many but in some cases may have not put the connection with the NRC's plan. But I guess the conclusion that I'll leave with you at the beginning, and I'll come back to it at the end, is we think that there's very good alignment, pretty much end to end, and we just need to work toward focusing our resources on the relative high priorities in each of the three or four areas that I'll talk about.

Next slide. So real briefly, I think it came up earlier today, but you all know that the DOE pretty recently issued its vision and strategy document, which focuses on the deployment of both light-water based SMRs and advanced non-light water reactors. A draft of that document went out in May of 2016. The DOE collected input from industry stakeholders and then, based on that input, made a revision to the plan and then issued in its final form just a short time ago.

One of the pieces of that plan that I'll talk about over the next couple of slides is it has a very specific near-term focus on the development of an NRC regulatory framework for advanced non-LWRs.

So the couple of key priorities and focus areas within the plan are, first, to accelerate deployment of a variety of advanced technologies through appropriate partnerships with industry and universities and working to be sure that we're taking full advantage of the capabilities and maybe past work that's been done within the national lab system in support of the commercial private sector.

The couple of time lines that are included in there are to enable commercial deployment of the water-based SMRs in the mid-2020s and the commercial deployment of advanced non-LWRs by the 2030s. And I want to spend a minute or two in the next slide or two better clarifying back to your point earlier, Dr. Corradini, what 2030s means. I think you made some reference to the options study, as well, so I just want to spend a few minutes on that picture, if you want to go to the next slide.

This chart or waterfall chart is taken from the DOE vision document, and it's written in a way that includes, if you look at the third and fourth line there, it includes reference to the gain initiative that's currently underway and also

a sequence of development and testing that includes the development in deployment of a test or demonstration reactor to gather additional information on a path toward commercialization.

So this is reflected in this figure to show all of the steps that any technology might endeavor down, including the less mature technologies. But what I also wanted to point out is in that 13 to 15-year time frame that you mentioned earlier from the options study, that's 13 years to start a commercial operation. And it's associated with some of the technologies that are considered to be more mature.

And so in those cases, the third and fourth of the five lines here would probably be eliminated or not implemented in that way. So then that gray line at the bottom, which would move for the commercial build and operation, would move about five or six years to the left. And so when we say 2030s, in that sequence of events, in the course of about 13 or 14 years, you'd be at a place where you'd have a technology design, license, built, and starting operation.

MEMBER CORRADINI: That matches what the option study had. They had a different bar

chart but same conclusion.

MR. KINSEY: So the option study is essentially speaking of, for the more mature technologies, it's basically the first, second, and fifth lines of this chart. The fourth and fifth are the less mature, so this is just to provide a complete picture.

MEMBER CORRADINI: The reason I brought it up to the staff was that the conclusion, as I remember the conclusion from the option study, is that it's technology independent in terms of cost and schedule. So whether I have a mature technology, whether it's gas or sodium, it has some length of time and potential investment, which is different than if it's less mature and I can pick a less mature, which would be a good five or six years, as you indicate here.

MR. KINSEY: Right. In the example, it speaks to sodium fast reactors and modular HTGRs as the two categories of more mature. Again, those would be lines one, two, and five here nominally.

MEMBER REMPE: So for the less mature ones and knowing how long it's taken to get the gas reactor to have a commercial vendor making the fuel and start the irradiations, I might buy that time

chart. But, boy, for the other ones where they don't even, even the sodium reactor, I don't believe they have a commercial vendor who's starting to fabricate the fuel and then getting the irradiation data. I'm having trouble -- I mean, is there some sort of belief that you can do a molten salt reactor fuel faster and get it qualified than an evolutionary light-water reactor fuel?

MR. KINSEY: I'm not familiar with the specific details of the molten salt reactor fuel qualification plan at the moment, but I could make sure that the right folks are available on the phone in tomorrow's session and we could go through that --

MEMBER REMPE: I'm just curious on why it's even envisioned to be plausible, reactors for which they don't even have a commercial vendor fuel. Again, there's so many, 50, 60 folks proposing this, I might why not acknowledge some of these are just going to take longer to get through it?

MR. KINSEY: Yes, I think in a lot of our dialogue with the reactor development community, we bring fuel to the forefront as an item that they really need to think through pretty

early in the process. You know, I think some of those organizations tend to start with a focus on reactor physics, and that's part of the concept, and maybe don't start on fuel quite as early. So we've been trying to stress the fact that you need to make sure that that's part of the story. And I think in some of the NRC workshops, I know for sure in the last NRC DOE workshop that was held back in the fall, I think fuel qualification was a specific item on the agenda where that topic was discussed. But I think it's recognized.

MEMBER REMPE: Thank you.

MR. KINSEY: So the key point I wanted to make in this slide, as well as clarifying that time line, is that you will see that the first item out of the chute in this waterfall chart is the development of the regulatory framework in parallel with some R&D work, and it's on a, you know, it's on a three to five-year time line, which is what I'll be speaking to here through the rest of the discussion.

So any questions about this before we move on? All right.

So on the topic of framework, I guess we've observed that that term is used pretty

regularly in a lot of different circles, and I think it's maybe not used consistently or it means different things to different people. So within the bounds of what we're doing in the DOE programs and the way we look at it in this licensing or regulatory area is we see the framework as really being or as really having four key constituents. The first three are really related to what are the rules of engagement, and then the fourth one is the process that you use to move an application through those sets of rules.

So the first is the Commission policy issues topic. The second is the need to adapt the LWR-based structure to advanced non-LWRs. The third, which is closely related to those first two, is what are the licensing technical requirements that come from those and how do those three fit together. And then, as I said, the fourth is establishing the review process that would apply and that you might use for a sequential or a phased review in some cases that I think others later in the afternoon are going to talk about.

A couple of things that we wanted to clarify, though, were that on the near-term deployment path, we don't believe that an entirely

new regulatory framework, which is sometimes referred to as Part 53, is needed. Our view of the world and how this will play out is that we need to work through the near-term adaptations, get some experience from one or two technologies moving through that process, and then, in a longer period of time, in the 10 to 15-year time line, we'd be in a position where we could develop a Part 53 or that sort of approach if it looked like that made some sense, and that would bring some deficiency and further clarity to the process. So, again, in our view of the world, when we say framework, we're talking about those four beings but not Part 53.

MEMBER REMPE: Aren't some of the bills that we see in Congress, they're called the NRC modernization bills or something like that, and so has that message from DOE gotten to the folks on the Hill that are proposing those bills?

MR. KINSEY: We work on those messages.

MEMBER REMPE: Okay. Just curious.

MR. KINSEY: So, again, this is back to the four major parts of the framework that I just mentioned. And, again, DOE is very focused in working with industry and with NRC in priority areas where we can retire or reduce the existing

areas or levels of risk.

What I'll be talking about next, we really focus our activities on the three boxes to the left, which are all somewhat intertwined. Some of those are relatively longstanding issues. And then the work to support industry, where needed, in developing the various review processes. And, again, I think some of the other industry folks will focus on the stages of review or that topic a little later this afternoon.

So, again, the bulk of our programs are focused on the three items on the left.

MEMBER CORRADINI: The bulk of DOE's programs?

MR. KINSEY: Yes.

MEMBER CORRADINI: Okay. But I'd be very curious as to what your conception of staged is versus what staff just discussed is their idea of staged, whenever it fits within your 15 minutes.

MR. KINSEY: Just real quickly, I don't know that I have it necessarily a view of staged. I've heard it used in a couple of different ways. One is the approve the DCD one or two chapters at a time, and the other is get sequential levels of confidence over the whole design, which is I think

the one -- and I've heard both of those discussed, and there may be some pursuit of either or both of those options. So I don't get too hung up on what stage means, but those are the two uses of the term I've seen.

MEMBER SKILLMAN: Jim, why do you offer that the risk is constantly decreasing as you go through this process?

MR. KINSEY: I guess when I say risk, maybe that was not the perfect term, but I don't want to cause any confusion there. It's really a reduction or a retirement of uncertainty.

MEMBER SKILLMAN: Licensing uncertainty?

MR. KINSEY: Regulatory uncertainty. It wasn't intended to mean societal risk or anything like that.

MEMBER SKILLMAN: Did you anticipate that you'd get three-quarters of the way through this and have some reviewer say, oh, I forgot to tell you this, and all of a sudden you have to reset your risk curve or your licensing uncertainty curve?

MR. KINSEY: That's why we've been working very closely with the staff to try to work

toward having the outcomes that we work through documented in a way so that we eliminate or at least minimize that potential. This regulatory guide that's coming out shortly that's in draft form now on the advanced reactor design criteria is one, an example of that. We're trying to formalize some of these outcomes so that they're, you know, a little more concrete going forward.

MEMBER SKILLMAN: Okay, thank you.

MR. KINSEY: Next slide. So you've seen this before, so I won't spend much time on it. But, again, in the near-term area, we're really focused on Strategies 2 through 5. We recognize there are a lot of interconnections and integration between 3 and 5, but, again, I'll be talking a little bit or primarily about Strategies 2 through 5.

I think, as Amy or one of the earlier NRC presenters mentioned, we do in the DOE and lab system support some of this knowledge/skills transfer activity. I think it was mentioned DOE supporting some through the Oakridge National Laboratory some training on molten salt reactors. But, again, I'll be focused on 2 through 5.

So we worked to get input for the

number of different places in industry. A number of recent examples is there was a joint response or DOE GAIN in EPRI modeling and simulation workshop. I think Steve Bajorek mentioned that, and that was a very good exchange of information. We worked very closely through some relatively recently-established groups within NEI. Those have been around for about a year and a half or so. There's an advanced reactor working group and, under that working group, an advanced reactor regulatory task force.

We work closely, as well, with the Nuclear Innovation Alliance and with the Nuclear Infrastructure Council, who you'll hear from shortly. And then we've had a series of workshops, and we still continue to get inputs through the DOE technical review panel.

So the message here is we're working, we're trying not to work in a vacuum and we're trying to go after the things that the industry tells us is causing them the most difficulty in moving their designs forward.

This is just a shorthand depiction that I'd like to use that tends to tie a lot of the various topics that we've talked about together.

MEMBER CORRADINI: So can I just, going into this picture, I think I've seen other versions of it.

MR. KINSEY: We should have copyrighted it. Sorry.

MEMBER CORRADINI: You should have. I'm not sure how much money you'll get out of it. But what this tells me is there's enough interrelation that having something staged in little bundles is a pipedream.

MR. KINSEY: I would personally agree with that.

MEMBER CORRADINI: Okay, thank you.

MR. KINSEY: So the depiction I have here, if you look at this sort of as a tree, if you look at the trunk of the tree, the key foundation to the whole licensing story, and I think we've mentioned it a couple of times this morning, is you really have to have a process for identifying or selecting the events that are going to challenge the system. And as you work through those challenges, you know, they challenge moving up through the center. They put some challenge on the fuel, which creates some potential release mechanisms of the fission products, and then you

have a series of boundaries. That sequence of events generates a mechanistic source term or a series of source terms that then go over the fence on the site boundary --

CHAIRMAN BLEY: Just for me, because I look track of this every time I run into it, what's the mechanistic mean in mechanistic source term? What are you conveying?

MR. KINSEY: It's actually an evaluation of the event itself and all of the transport phenomena that occur in that event.

CHAIRMAN BLEY: A particular event, a particular scenario?

MR. KINSEY: So you're mechanistically calculating the source term, rather than using, for instance, the three-percent fuel melt prescriptive number that the LWRs use.

CHAIRMAN BLEY: So you're doing the best you can including uncertainty kind of --

MR. KINSEY: Right. And we include uncertainties in the discussion, but it's an actual evaluation of various release sequences.

CHAIRMAN BLEY: Okay.

MR. KINSEY: So, again, then there's a postulated release from the site, and that moves

into the emergency planning zone discussion at the top of the page.

So the way this is arranged or the way it tends to fit together is the bulk of the policy issues in the areas of largest uncertainty are in the trunk of the tree moving up through that chain. So topics like, again, the event selection process or, Joy, back to your point, how do you develop the fuel and have some certainty around the performance and what's the time line for developing it.

So those kinds of, the big-hitters tend to be in the trunk of the tree. The related research that helps to support that story tends to be in the branches. So for instance, in the lower right you'll see core heat removal, so we're supporting some work on passive heat removal systems. This is where a lot of the analytical code development work comes from.

So I don't want to spend a lot of time on this picture, but that's how we go about thinking about how the pieces fit together and where the relative priorities ought to be.

MEMBER REMPE: So the GAIN program, for example, since you're acknowledging that DOE is trying to emphasize the importance of the fuel, has

the way DOE is allocating funding showing that same emphasis?

MR. KINSEY: I can't speak to all allocations, but I can tell you that there's a, I think as you're aware, pretty consistent and large allocation or commitment to working through the particle fuel qualification program for HTGRs.

We have a similar, a bit newer program but a similar support effort in place where we're working with primarily the folks at Argonne National Laboratories and some of the sodium fast reactor developers to evaluate the historical data that's available from EBR2 to sort out both what's there and then what level of quality it had and whether that would be evaluated to be acceptable in today's world, so we can then do a gap analysis and sort out what's left to be done on the fuel qualification story for sodium.

MEMBER REMPE: So you'll have a better estimate then on the sodium reactor and how many more years because you've still got to go from the Argonne old data to a real vendor and things like that.

MR. KINSEY: Right. But we're starting down that path. And then, again, the molten salt

path I'm just less familiar with. Not that there isn't one, I just haven't delved into that one too much.

MEMBER REMPE: Thanks.

MR. KINSEY: Next slide. So just going through the four major pieces, they're not in the same order as the strategies are presented in the NRC document, but on the topic of policy issues, DOE is working to directly support the utility-led licensing technical requirements modernization project that Amir will be giving in more detail about later this afternoon. And that's being coordinated through or closely with NEI.

A couple of other policy-related activities that we've been engaged with are the joint initiative with NRC on adapting or developing adaptations to the general design criteria. I think the picture that industry was faced with three or four years ago was, if they were going to move into developing principal design criteria, they may have had the right 10 or 15 or 20 exemptions from the GDC, which was just an insurmountable task for everyone. So --

MEMBER CORRADINI: Was that done for Clinch River, PRISM, and Fort St. Vrain, just to

take history there? Did they have to have that level of exemptions to get through the current --

MR. KINSEY: We used those activities as inputs into what these criteria ought to look like, but I don't recall that they actually got to the point where they were processing exemptions. I don't think they were quite that far, you know, into the process.

MEMBER CORRADINI: I only ask because I'm just looking at how staff dealt with it at those time periods.

MR. KINSEY: At this point, the staff has used the lead-in language in Appendix A that mentions that the GDCs are representative of what might apply to a non-light water reactor until they found the, we've agreed and found a way to work through this new guidance as an adaptation, rather than an exemption or a rule change.

So I already talked about fuel testing and passive cooling system testing. I think you all are familiar with a lot of the DOE programs on materials.

And another item that just came up a little bit before I came to the front here was the topic of the standard review plan. So we've

actually been working on a pilot that looks only at Chapter 4 on the reactor for both the sodium fast reactor and the modular HTGR. We're wrapping that up in the next couple of weeks, and we plan to spend a little time talking about the results of that activity in the April workshop, the DOE/NRC workshop. And the purpose of that was to figure out if trying to adapt or re-write NUREG-0800 is the most efficient way to move forward and, if it is, to decide what sort of resource it would take to do that for those two technologies, again, as a pilot.

The other thing I guess I'll mention is we've started, in the last two or three months, we've started some pretty regular dialogue with the NRC team, a lot of the folks who were up here at the table before, on, nominally, about every six weeks time line. And that's really moving into sort of a working group format, which we think is going to be the most efficient and the best way to work through a number of these topics. So we really do appreciate the opportunity for those kinds of interactions, and we'll continue to support the industry in making those go forward.

Next slide. On the topic of analytical

tools development, I think I've already mentioned some of the workshops and some of the other interactions that we've had there. The dialogue that we've started with NRC is that, within the national lab complex, we've either done a lot of this work or have the capability to do a lot of it. And I think the challenge in the near term is to work closely with both NRC and industry to figure out which of those tools in that long list are the more important ones and also sort out how the national lab complex can engage in supporting these efforts while keeping the industry and the NRC adequately independent. And there's some judgments that we have to work through there on each of those, but we're prepared to continue to support that area. I think it's an area that needs some prioritization and clarity on, again, whether we're developing an industry tool or an NRC tool or one that might be able to be used by both with certain controls.

Next slide. In the codes and standards area, again, we have the capability to do a fair amount of support work there of industry. What we're doing right now is, again, another pilot study that we've discussed with the folks in NRC

research who are involved with that part of the business. And what we've essentially done is, again, we're doing a pilot on just a handful of codes and standards that could be applied to a sodium fast reactor to sort out how large that effort is if we were to do something on a more technology-expansive basis and how we might go about prioritizing the codes and standards that are out there.

It turns out that there are, depending on how you count, there are about 900 out there right now that apply to, in one way or another, to an LWR. So, again, we're just doing a small pilot on a small subset for an SFR to see what a viable path might be for a non-LWR.

Next slide. And then, again, on the stage regulatory review process, we maintain awareness of what's going on there. We provide input through the working groups that we participate in with NEI, but we really have left this more to the reactor developers and their associated license applicants to sort out. And they've been doing that through the three industry organizations there.

And I think that's all I have. Any

other questions?

MEMBER REMPE: Just as a history lesson, Mike asked the question about the Fort St. Vrain is filed back with the Atomic Energy Commission and way before the GDCs were in place. And I'm not sure --

MEMBER CORRADINI: I'm sorry, Joy, I didn't hear.

MEMBER REMPE: It was before they had the GDCs and, in fact, it was --

MEMBER CORRADINI: In the 1980s?

MEMBER REMPE: It went operational, when they started out it was filed in application with the Atomic Energy Commission, and then I think it converted over with the NRC. I'm not exactly sure, but it was, they were before the GDCs were --

MEMBER CORRADINI: Right. But maybe I misspoke. I was thinking more about the mHTGR pre-PSAR review, as well as --

MEMBER REMPE: The 1980s thing, and I don't know on that one because --

MR. KINSEY: With the mHTGR, they actually did a, they did a GDC comparison in their FSAR or in their PSAR and have a discussion of the various applicabilities of those GDCs and then what

the alternative information ought to be. But they didn't get to the exemption stage because it wasn't an actual application.

MEMBER CORRADINI: All right, thank you.

MR. KINSEY: But we used that as very direct input into this current effort.

MEMBER CORRADINI: Thank you.

MEMBER POWERS: In your slides, you mention very frequently DOE and the national laboratories collaborating on this and that. One of the issues that I've always been curious is suppose that an applicant came forward and said I've used this super computer at the national laboratories that does billions of FLOPS per second and calculated this result, and that's the validation I have for these contentions I have in my license. How do you suppose that the staff would possibly do an independent verification of that calculation?

MR. KINSEY: A couple of pieces of that. The first thing that we've been working to do is help, especially some of the less mature developers, help them in thinking through which tools they're using to learn more about their

concepts versus which tools and their outputs would actually be used to support a reasonable assurance conclusion with the staff and be part of their application. So we've been working through that.

And then the second part of the answer, I guess, would be we're trying to help the industry folks with support through the labs identify the paths that they intend to be on through this licensing project plan initiative that NRC mentioned so that, if that sort of a proposal is going to be coming to the staff down the road, we can all have some dialogue around that at the beginning of the process to sort out an option to address just what you said. I don't know that I can give you a specific solution, but I think the intention is that we're working to help be sure that the industry doesn't surprise the NRC with something like that that they're not able to deal with on a timely basis.

MEMBER POWERS: So you're saying either such a thing will never occur because you've tutored people not to do that sort of thing or that, if it does occur, that some mythical strategy will be invented to handle it?

MR. KINSEY: I don't think I'm

suggesting that all available tools wouldn't be taken advantage of. All I'm trying to suggest is that we need to stay closely coordinated from the beginning in those kinds of evolutions with the regulator so that everybody can sort out how to best implement their responsibilities as we move down the road.

MEMBER POWERS: One of the problems that we've consistently had is that when an applicant comes forward and says, yes, I've used one, then this fluid dynamic sort of thing with wonderful view graphs and gotten this result is that we find it almost impossible to review that because we don't have access to the convergence criteria built into a commercial code.

MR. KINSEY: I understand.

MEMBER POWERS: It's been a persistent --

MR. KINSEY: Again, I don't know that it's the perfect answer, but I think that's the kind of thing that I would expect an applicant ought to flesh out with the staff through the project plan, any of those big-ticket longer lean time issues.

CHAIRMAN BLEY: Anything more from the

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MEMBER MARCH-LEUBA: Yes, I do. I also come from the national laboratory background and just to work out for NRC, and the word conflict of interest was the kiss of death. It didn't matter what you thought was reasonable. It didn't matter what you thought was logical. It's what the law department told you to do.

Now, DOE is almost acting like an applicant here. Have you guys talked to the law department to make sure that what you're planning to do is okay?

MR. KINSEY: I think, at this stage, we're continuing to do technical development work that supports the reactor developers, and I think we're at the stage where, as described in the NRC's IAP, they've recognized or have an interest in leveraging where it makes sense and where it's legal to do so so that we aren't developing, you know, two or three sets of the same sets of tools.

MEMBER MARCH-LEUBA: Under the rules they made me work, and, of course, I didn't have the budget you have. I could not do that. So before we hit a wall somewhere ten years from now, it would be nice to at least involve the law

departments and make sure that they have an agreement that this is okay.

MR. KINSEY: I appreciate that input. And, again, the slide that I had there and my conclusion was that we really need to start working toward the implementation plan.

MEMBER MARCH-LEUBA: But, I mean, as I said, it wasn't what was reasonable or what was logical.

MR. KINSEY: I agree. Attorneys are an important part of that discussion.

CHAIRMAN BLEY: Mike, you were saying something.

MEMBER CORRADINI: I don't want that on the record. So I want to get back to about a plan. So has DOE given this way in which that you're interacting with potential applicants, has DOE or have labs suggested a reorganization of how DOE actually handles advanced reactor development, I'll call it research and development, versus demonstration and deployment? Because it strikes me, until there's a reorganization of it, the process may not all fit together nicely.

In other words, I'll just throw out the idea that --

MR. KINSEY: Yes, give an example.

MEMBER CORRADINI: Well, my example is that if truly NRC, in terms of criteria and planning, is looking at sodium, gas, and other, other being molten salt, one would expect to see project offices at DOE that would help organize, help provide appropriate research and development of information so that applicants or vendors could actually do something along those lines. It strikes me without that sort of organizational structure, there could be lack of optimization on the non-NRC side.

MR. KINSEY: There's a structure that has recently come together that centered around technical directors that have to do with those individual technology types, and they have a responsibility to work to coordinate the related research and technical development work that's going on to be sure that those activities are filling the right technical gaps.

MEMBER CORRADINI: Within the last few months?

MR. KINSEY: It's pretty recent, yes.

MEMBER CORRADINI: Thank you.

MR. KINSEY: And I'm working from the

licensing side to help them on the, you know, the tree picture, to help on the regulatory inputs.

MEMBER CORRADINI: I mean, this is really not our purview, but, on the other hand, I bring it up since you're looking to help, rather than lead. It kind of gets back to Jose's question about I don't view you as the applicant, I view you as potentially providing research and development information that would help the applicants in their dealings with NRC.

MR. KINSEY: Right. And, again, the DOE is working in a way of structuring its communications with the lab so that they tend to focus on technology areas like that.

Anything else?

CHAIRMAN BLEY: Anymore from people? I guess we'll turn it over to David. David, I apologize, but, given the way people butcher my four-letter last name that starts with B-L-E, I'm going to ask you to introduce yourself.

MR. BLEE: I was wondering if you were a cousin of mine. David Blee. I'm the Executive Director of the U.S. Nuclear Infrastructure Council, and I bring regrets from Commissioner Merrifield. Jeff was going to be here today. He

had a last-minute development at his day job. It's actually a very positive development, so you'll hopefully see an announcement on that soon. But he sends his best.

You know, from my own personal point of view, it's great, it's my first appearance at ACRS and it's a very storied committee. Not very many committees, advisory committees are sanctioned with the Atomic Energy Act in 1954.

CHAIRMAN BLEY: Just one.

MR. BLEE: And, by the way, how do you pronounce your last name?

CHAIRMAN BLEY: Bley.

MR. BLEE: Bley? Okay. Captain Bley. There we go. But in terms of, this would not be an advisory committee unless, I have not actually been before a nuclear advisory committee that have not included Dr. Corradini, actually, who seems to be ubiquitous in everything I appear before. But good to see you, also, Doctor, and many others here at this --

MEMBER POWERS: We've been trying to escape him ourselves. We understand your pain.

MR. BLEE: I was glad that you actually delayed the first part of this morning because I

was able to, there was a Senate hearing this morning on advanced retro-legislation, so I was running late, but I was able to get the essence of the conversation, and I really commend you on your really good observations and questions. And if you're wondering how often you ought to meet, you ought to look upon yourselves as the board of directors, at least, I would say at this point, every six months on this subject. I think this has been a lively and useful discussion so far.

So the answer to your bottom line here is progress is being made, and I say that guardedly. And why do I say that? Before I jump into the weeds here on the presentation, I think that go up to 10,000 meters and then also go back a year ago, a year ago we had an advanced, we have an annual advanced reactor technical forum in which, and this is the third one at Oakridge last year, and Commissioner Ostendorff came down with the party line from White Flint, basically saying that they were open for business and, by the way, the NRC preferred one voice when it came to licensing matters and that it was looking forward to deployment in the 2035 to 2040 range.

Well, he got a real earful down there

on that thesis for a number of reasons. One is there was, the industry did not feel that the NRC was ready for a license application, they did not agree with the 2035 deployment, and they also felt that, in this case, in terms of where this is going, in terms of the end user, you may have utilities, you may have traditional utilities, not sort of non-utility generators, and potentially government users in the case of the new advanced test reactor or potentially in some of these demos.

So we did, since then, however, the NRC has moved with dispatch, I'll say, to address concerns and really that has been very, very brisk. And they have engaged with multiple stakeholders, although we have worked hard to coordinate our efforts with the coordinating group that we do with NEI Southern and NIA. They have held regular status meetings, held regular stakeholder meetings. And even though they have not gotten the resources from the Congress they've asked for, and, actually asking for resources was a great first step of the $5 million that's still pending in the continued resolution dispute or settlement, they have moved things along here.

In terms of the DOE has played a very

good supporting role. We think DOE is very, very important, probably early on and later, unless there is something on the DOE site, I think particularly in funding, in terms of the involvement of the national laboratories.

But I think, again, what we're trying to give voice to is the developers. They don't like to be called designers. It's technology developers now. It's the state of the art here. Technology developers. Some are very, very small, some are well know, like General Atomic, Westinghouse, General Electric.

And you also have had the Congress enter into this. In the last Congress, the Nuclear Energy Innovation and Modernization Act was introduced. It passed out of committee in a bipartisan fashion in the Senate side, and it was actually, a companion version, a similar version actually passed the House of Representatives. It came very close, one unanimous consent away from being passed.

In this Congress -- and there's also the nuclear NEICA, Nuclear Energy Innovation and Capabilities Act, just figured these things out during the congressional recess, which basically

deals with demos and test reactors, which has already passed the House of Representatives this year, as well as the licensing modernization on the House side and you had a hearing today.

So things are moving very, very fast, and they've got some sweeping mandates, not just necessarily on modernization, something you'll hear about from Amir further, but on the issue of NRC reform in terms of fee structure and that sort of thing.

Our emphasis has been on the early, being a business consortium, we're focused on nearer-term actions and really pre-licensing, NRC readiness for pre-licensing engagement, pre-licensing engagement, and then engagement.

CHAIRMAN BLEY: Since you've said what you are, can you give me a little tutorial on the Nuclear Infrastructure Council? Just what is the organization and how are you structured with the other people who you're serving.

MR. BLEE: Yes, Mr. Bley. Thank you for that question. Or Dr. Bley probably.

CHAIRMAN BLEY: Probably, yes.

MR. BLEE: We're focused on new nuclear energy and the promotion of the U.S. supply chain

internationally. So it's on research of nuclear energy in the United States. We're a business consortium. We have over 90 member companies.

CHAIRMAN BLEY: Are they all developers?

MR. BLEE: No. We have about 14 developers.

CHAIRMAN BLEY: Okay.

MR. BLEE: And we are focused on four, about five things: key movers, you know, basically, Gen 3+ deployment, but then also, since Dr. Chu wasn't able to resolve it, the back-end, resolving the back-end path forward in terms of supply chain readiness and manufacturing innovation, and advancement of technology. That's what Jeff Merrifield's, he chairs our task force on that. And finally it's the whole international paradigm in terms of export controls, 123 agreements, those sorts of things.

So we're not just focused on advanced reactors, but we feel -- and, by the way, we're agnostic on technology advancement. We're entirely supportive of Gen 3+ SMRs, advanced reactors, all moving forward in parallel.

So we're multi-faceted. We're just

focusing, again, on resurgence of nuclear energy in the United States and the involvement of the U.S. supply chain internationally but a very business-driven focus in that sense. In terms of -- and it really includes the whole, you know, panoply of household names that you would expect, starting with GE, Westinghouse, AREVA, NuScale, CB&I, Fluor, AECOM, etcetera, etcetera, moving on down the whole supply chain. Southern key mover utilities, as well.

So, again, our focus has been on the pre-licensing engagement. In particular, we wonder if we're not focused on the right thing in the sense that one of our members, Terrestrial Energy, has said that they're going to submit a license application in 2018, is it? 2019? 2019. And to us, that becomes, not because it's Terrestrial but because the fact that someone is going to come here with a license application.

We have issued a white paper on modernization, and, basically, it really advocates far more emphasis on NRC readiness in terms of not learning about a technology on the customer's nickel, learning about it beforehand, and then in terms of really kind of a cost-share with respect

to the engagement.

We actually don't like the word, the use of the term "quality review," Dr. Rempe, in the sense that we think, actually, the NRC, if an applicant fails, we really think, in large part, the buck stops with the NRC on the lack of a quality application.

So, again, we are --

MEMBER POWERS: What exactly does that mean, the buck stops at the NRC?

MR. BLEE: The buck stops? You've never heard that term? I think it was Harry Truman, I think, or was it Ronald Reagan?

MEMBER POWERS: I'm aware of that. Why does it stop at the NRC?

MR. BLEE: The view is, in the past, when they've sent, mailed back the application to folks, they sent, they've said, you know, it wasn't a quality application. Well, I mean, you can say that all day long. The fact of the matter is if you have a customer of yours that fails, you should own at least part of that.

I mean, in the past, this past year, on an early-site permit, they mailed back, they didn't mail it back but they essentially almost did mail

it back, the TVA application for the SMR at Clinch River. You know, it seems to me -- so NRC has to own that, as well. As the customer, they can't just say, you know, it wasn't a quality application and we're off the hook.

MEMBER REMPE: Let me be clear. I'm not saying it's not a quality application. I'm saying does the applicant have a process that involves some sort of peer review, technical peer review? And that is part of the vendor design review that the Canadians use, which is going to be referenced later in your slides.

MR. BLEE: Yes.

MEMBER REMPE: And so I'm thinking that might be a good thing to emphasize early because the Canadians have said we get higher-quality applications if we emphasize early on that they have some quality process in place. And so that's what I'm trying to get to. It's important to have a good quality application, but processes that have peer review and some sort of technical review might eliminate what happened with Transatomic Power, right?

MR. BLEE: Right. I agree. And you did use the term "popular press," which I don't

think is being used very often these days.

MEMBER REMPE: Oh, yes.

CHAIRMAN BLEY: It depends on where you come from, I think.

MEMBER SKILLMAN: Let me support Dr. Rempe for a second.

MR. BLEE: Sure.

MEMBER SKILLMAN: We speak as individual members here on the subcommittee, so whatever comes out of the subcommittee is Joy's point of view, my point of view --

MR. BLEE: I wasn't personalizing because I'm sure that quality --

MEMBER SKILLMAN: I know, I know. Let me offer a point of view that I, for one, advocate very strongly. I think if a vendor comes in and puts in a C-minus application, the NRC ought to return it and say file a Part 21 on yourself. And what that does is that forces an extended condition and it forces that vendor to look very introspectively of what went wrong, that the burden is not with the NRC, it's with the equipment vendor who just happens to be peddling a reactor design.

MR. BLEE: Right. I would agree with you. I would agree that some sort of process other

than, hey, you didn't put a quality application in. There's some kind of step-off, and I think they have tried where they have had applications where they effectively would have mailed them back, but, unfortunately, it seems that -- and then it gets picked up by the antis, and, you know, it could be used as an excuse.

But I agree there should just be, like anything else, a very transparent. You shouldn't be accepting C-minus applications.

MEMBER SKILLMAN: Well, you know, if you buy an automobile or a truck and there's a recall, GM or Ford or Chrysler or somebody fixes that at their expense, not yours, and you get a notification, and the notification is dear Mr. or Mrs. so-and-so, please return your vehicle for this fix. That is not a bad analogy here.

I can tell you that I've been involved with design certs where we've pointed out the error by the design cert applicant, and their reaction was what do I do now, and we said file Part 21 and that assures that the process is filed. And those who have operated plants who bought equipment who have been through this understand what they get as the result of that is a mighty fine product.

But I just wanted to support Joy. I think she's right on the money.

MR. BLEE: It's better than a code red.

MEMBER SKILLMAN: That's correct, yes.

MR. BLEE: So just to -- how do you adjust the slides here, sir? Oh, okay. I'm going to walk through here real quickly because I know I had a big warm-up there.

Okay. So we've already gone through that in terms of, again, the emphasis here is we're giving voice, not entirely successfully as yet because of the resource constraints with some of the advanced reactor developers and the fact that they're focused on different stages. They really are focused on peer design in many cases. But that's what we're trying to give voice to.

In terms of the timing, I talked a little bit about the goalpost here. And, basically, again, beginning with the end in mind, I mentioned the Terrestrial application, but I was a little bit alarmed today to see your goalpost had moved back again. You said 2030s, which could be construed as 2039. But we felt we had got it forward to at least 2030. But we really think the market is telling us late 2020, so that's just,

again, beginning with the end in mind.

In terms of the DOE focus, you know, again, I think the DOE is playing an important role here, and Jim always is really value-added. I think, at the end of the day, if we do our job right, the DOE is really going to be sidelined, except potentially as an end user. So we want to give voice again to those developers and what their needs are, as opposed to having a government-centric type of approach, more free market.

With respect to -- so to that end, we are, we aren't encouraging NRC and DOE. We encourage them to collaborate but not necessarily to link their goals. The NRC should be linking their goals to what the end users are looking at and what those developers are looking at, rather than what their sister government agency is telling them to do, as important as they are.

I mentioned Terrestrial and that the fact that there's at least one other party that is in pre-licensing engagements. There is also, I believe you're going to get an announcement very, very soon about a very innovative new advanced test reactor moving forward in a really private-sector led fashion. Your schedule on that advanced test

reactor demo actually fits pretty well with that. So your goal posts are fine there.

You know, we are concerned that, basically, four of our members are seeking, and you talked about the Canadian model, several of you over here, with respect to the migration, the outward flow to Canada. Four of our companies have either filed, a couple have filed and I think two more are getting to get ready to get in the queue. And I think that the, you know, this is something where we think, actually, the Congress has recognized this, and I think they will definitize this further as they go through their markup because they've asked us for further input on this. But the attractiveness of the Canadian thing isn't, is the fact that, not that they do it, necessarily, just in a prescribed manner. It's two years, and the fact is it's a fixed price. They don't come and say, hey, we're going to give you a schedule and a budget for your design. They're saying for $5 million, basically right now, in two years, we will give you, you will have a benchmark in terms of the feasibility of your license application review.

So it's also, that fits into another

need in terms of it also offers a stage, the desire for pre-licensing engagement benchmarking and then a staged approach, and that represents the first stage. So that's the attractiveness to it. They don't want something in which they come in here and say, yes, it's going to cost you $15 million in three years. No, right now the Canadians say, maybe the price is going up because everyone is coming there, they're just saying two years and $5 million and, again, it's a phased approach. That's the first stage of their licensing process. And as you know, as you go through it beyond that, it's not, it is more of, I think, a phased approach. So we, again, with emphasis on pre-licensing review, we are pushing in the Congress and certainly with the NRC on that sort of paradigm.

In terms of the -- I think I've covered this here. Jeff, NRC staff to emulate the CCC, yes. We're also supportive, by the way, and I think it's very important to -- it's one thing to have a Canadian style pre-licensing vendor design review, but you also need to have off-budget money. We thought it's a very, very important step that the NRC took in asking for $5 million off budget, off fee base, to basically do the kind of work that

they do to get up to speed on the various technologies. We believe next year we hope it will be at least 10 - 15 million really, and, beyond that, in terms of we think that there's an appetite in the Congress for this kind of support, and we think that would be very, very helpful.

Frankly, the NRC has been working on fumes here, and we applaud them for the fact they just didn't shut down this whole development in the sense because they didn't get the money. They haven't gotten the money yet, and we're halfway in the fiscal year.

In terms of the -- I'm going backwards. Actually, going forward, Jeff did want me to mention about the higher assay LEU. It is, I think, as you know, the work on the fuel, as Dr. Rempe mentioned, is very, very important or critical. I think that a lot of progress was made this year under the aegis of the DOE in that regard. I think that there is an issue on higher assay LEU, and we are trying to work towards some sort of path forward on that because there's some concern there won't be higher assay LEU available to the reactor designers going forward, and we haven't really gotten much clarity on that and

that's something that we're pursuing.

In terms of -- let's see.

MEMBER KIRCHNER: David, pardon my interruption here. Could you be explicit? Is this an issue for DOE and the government, not an NRC issue --

MR. BLEE: No, it's not an NRC issue, but it's an issue that Jeff mentions everywhere he goes, so he put it in here.

MEMBER KIRCHNER: Okay. I just wanted that clarification.

MR. BLEE: Yes. No, it's --

MEMBER KIRCHNER: There's nothing about, inherently about licensing less than 20 percent of --

MR. BLEE: No, no, no --

MEMBER KIRCHNER: -- fuel line other than to criticality issues, etcetera.

MR. BLEE: This is really a DOE issue. And we've got the DOE here.

MEMBER KIRCHNER: Okay.

MR. BLEE: In terms of the vision and strategies, some specific comments from Jeff. In terms of the executive summary, the staff states NRC recognized that non-LWR vendors may wish to

commence re-application activities or submit applications for review in the near term in advance of the DOE supplement goal. We believe it is positive that NRC is not tying itself to the DOE deployment goal. I already addressed that issue.

The document discusses the use of computer models and analytical resources. And a point here is that we support and approach that maximizes collaboration, minimizes cost and duplication. We have every indication from the NRC staff that they're pursuing that option, rather than re-inventing the wheel.

On page seven, the staff emphasizes the need to identify policy decisions appropriate to govern the acceptability of non-LWR designs and recognizes several of these, as well as some which may apply to both LWRs and non-LWR designs. And we support the need to readily identify these policy issues.

And later on this month, we will be presenting some findings from our Advanced Reactor Technology Owners Group to provide a prioritized roadmap to what I think Amy presented earlier this morning in terms of the actual developers. So stay tuned on that.

Let's see. Also on page nine, NIC continues to be concerned regarding language discussion of the prioritization review and the NRC identification of which particular technologies are more likely to come ready for the Agency's regulatory review. In general, we don't like the government picking winners and losers. That's number one. But at some point, the market will pick winners and losers, and the regulatory process will pick winners and losers in the sense that those who are able to have the resources and the fortitude to get through the process will get into the end zone.

In terms of the -- we believe that the role of the Agency is to establish a set of risk-informed performance-based licensing requirements that are, to the extent practical, technology neutral and provide a framework for various advanced reactor technologies to move forward.

We're concerned with this language because it leaves the impression that the Agency may attempt to make a qualitative judgment about various reactor vendors. And NIC's view, as long as the applicant meets the NRC requirements and pays the applicable fees, it should have the

opportunity to have its design reviewed in a timely fashion.

MEMBER REMPE: Excuse me, but your third bullet about the you want a risk-informed performance-based licensing requirements for the advanced reactors, is that in conjunction with we're going to have the applications starting to be submitted by 2018 and something could happen by 2020 --

MR. BLEE: Oh, you have until 2019, I think.

MEMBER REMPE: Oh, 2019. So you want this to happen, the modernization of the framework in time for your first movers; is that your vision?

MR. BLEE: Not necessarily just my vision, but that's Congress's vision. I mean, the Congress is going to come out with a bunch of edicts basically saying within 180 days the NRC has to do the following. So, you know, that's the conundrum.

MEMBER REMPE: It is a conundrum, and so maybe some people need to work with those, coming up with those edicts and --

MR. BLEE: Well --

MEMBER REMPE: And so I'm just curious,

your organization seems to be involved with some of those bills, I guess, at some level or something.

MR. BLEE: Well, we've been asked to comment on them. You know, well, Congress does things in sweeping ways. I mean, they're basically going to bat the ball in the NRC's court on a number of them saying 180 days put on something that addresses, you know, more effective pre-licensing engagement, do this, do that. And that's not necessarily the way we want it --

MEMBER REMPE: So you don't agree with that? That's just what you think Congress is doing is what --

MR. BLEE: Well, I would say that Congress is -- when I say don't agree with it, I'm saying that that is, that Congress is, that's normal for legislation in terms of a regulatory agency. And rather than actually put prescriptive, something prescriptive in, they're asking for the NRC to come back, you can look at it in a positive way, they're asking for the NRC to come back with a prescription that addresses their concern.

So, you know, the other way of doing it would be to say here's the prescription and go implement it.

MEMBER REMPE: But your vision is that that's, again, not Congress's vision, but your vision is that probably that's not a realistic approach? Is that, am I putting words in your mouth?

MR. BLEE: Oh, no, no, it's very realistic. We think that we have to move with urgency, so the Congress is moving with urgency. We applaud that. And so if you're really going to have an application in here by 2019, we're going to have to move vigorously, and 180 days is a half a year and that should be sufficient for the NRC to come back with a response to the Congress.

So, no, I think that it is sweeping. We didn't write them. But that is typical of what you'll see in legislation. The fact is that Congress has got involved in this issue. They're responding to concerns they have in terms of the readiness on a non-light water reactor licensing, and we can't just use the same play book that we did for light water reactor licensing.

MEMBER REMPE: So, again, your view, though, forgetting about what Congress has in these bills, is that it's best to have a new framework to address this 2019 application? That's what your

view is --

MR. BLEE: We need modernization and reform, so we're pleased with the urgency that Congress is moving. We're also pleased with the urgency that both the NRC and the DOE are moving. Now --

MEMBER REMPE: Because we heard earlier today the NRC, you know, in the long term that may be useful, but if we want to get something done in a hurry we ought to work with our existing framework. And you're saying something different. That's why --

MR. BLEE: We're not saying Part 53 either. That could be something that NRC comes back with. But what we see is modernization of the existing framework and --

MEMBER REMPE: Be specific. I mean, the GDCs, that's something that's underway and --

MR. BLEE: Amir is going to tell you all about this.

MEMBER REMPE: Okay. But you don't have a view that you want to convey? Because he'll talk later, but I just am curious on your view.

MR. BLEE: My view is Amir's view, actually, on that subject.

MEMBER REMPE: Okay. We'll wait to hear from him.

CHAIRMAN BLEY: That's pretty slippery. I invite you to comment on the NRC's near-term action plans document. Do you have any opinion on those?

MR. BLEE: With respect to --

CHAIRMAN BLEY: Are they heading in the direction you're looking for, or do you think they're going in the wrong direction?

MR. BLEE: They're definitely headed in the right direction. I mean, it's been very logic -- your vision and strategy, then you go to implementation, action plans, then you have near-term, medium-term, longer-term, and now you're going into the devil is in the details, of course. And that's where we're all going to have to roll up our sleeves and provide input.

CHAIRMAN BLEY: Well, since you bring up the devil in the details, you were really positive on what the Canadians are doing. We've talked to them. How many people have gone through this Canadian process and actually got a license for anything? A license.

MR. BLEE: Oh, actually gone through

the vendor design review?

CHAIRMAN BLEY: Yes, and ended up getting a license.

MR. BLEE: I'll have to submit that to --

CHAIRMAN BLEY: Why then do you have confidence that what they're doing is going to be a faster way to getting a license?

MR. BLEE: We have confidence that they can, in terms of they have done this process in terms of design review. I was up in Ottawa last year --

CHAIRMAN BLEY: Yes, and they say here's our stamp of whatever it is on the design review, you're on the right track if you go ahead, but nobody has ever carried it through.

MR. BLEE: Well, I mean, the fact of the matter is why are companies going there instead of going to White Flint, okay? They're looking for surety, they're looking for fixed price, they're looking for fixed schedule, they're looking for something that is phased.

CHAIRMAN BLEY: They might be looking for a stamp so they can go somewhere else and sell a design.

MR. BLEE: Looking for what?

CHAIRMAN BLEY: You know, an approval so they can say the Canadians approved this and you ought to buy my design, but nobody has ever gotten a license from the Canadians going through this process. We don't know it's faster, and we don't know it's cheaper.

MR. BLEE: Well, we do know --

CHAIRMAN BLEY: Getting to the point is cheaper.

MR. BLEE: What we do know is they're promising that they will do this in two years with a fixed price.

CHAIRMAN BLEY: With a design review.

MR. BLEE: And that they have four companies queuing up to use it.

CHAIRMAN BLEY: Yes, we know that.

MR. BLEE: So we'll see in a couple of years, presumably.

CHAIRMAN BLEY: But they aren't getting a license at that point.

MR. BLEE: No, they don't get a license. It's a pre-licensing interaction.

CHAIRMAN BLEY: They're giving them the kind of thing that has been issued by, at least my

understanding, by the NRC to people who come in and say --

MR. BLEE: Well, Andy's point, we have the same capability, the same thing here. Well, if --

CHAIRMAN BLEY: If you bring something in --

MR. BLEE: They weren't sure of the time and they weren't sure of the price. So that's the issue. If they had a fixed price and a fixed time and it was a reasonable period of time, you know, it wasn't five years, I think people would be coming here. Why is the market going to Canada instead of coming here if the process is available here? I rest my case.

MEMBER KIRCHNER: So, David, maybe I could follow up with Dennis.

MR. BLEE: But I'll find the answer to your question, though. The Canadians spoke very glowingly of this when we were up there.

CHAIRMAN BLEY: I think I know the answer to my question already, but I'll appreciate it --

MEMBER KIRCHNER: Well, you get that licensing ability statement and then you go to,

effectively, what is our 10 CFR 50 process. So it's more about making a statement to raise funds than it is about the in-depth technical quality of the application and the design concept.

MR. BLEE: Well, just like, so just like getting a loan, qualifying for a loan guarantee.

MEMBER KIRCHNER: Precisely. It's --

MR. BLEE: From your investors, some of these people are looking to have it financed, and so it provides yet another positive objective indicator to them. So if this was coming out of --

MEMBER KIRCHNER: But you want the end result, and I can understand the value of it, but do you also want to, for some of your applicants, incur the other requirements in the Canadian process that opens them up to an in-depth quality assurance program review?

MR. BLEE: We don't get no --

MEMBER KIRCHNER: You're picking and choosing what you want. I see the value of the end result, but are you prepared to actually adopt the Canadian process. At least as I understand it, it would require a higher bar than perhaps our NRC colleagues were asking of potential applicants.

MR. BLEE: Well, we're advocating more pre-engagement, generally speaking, across the board.

MEMBER KIRCHNER: Unfortunately, you weren't here this morning. I pressed pretty hard on this because I think it's advantageous for you on the applicant's side or potential applicant's side down the road, as well as the NRC, to have some clear understandings about what these terms mean. What is a license ability statement? I'd like to see the definition of that. And what is required to achieve that result by the staff? And then both sides would enter this phase with some ground rules or whatever to get to the result you're looking for.

The Canadian process, on the surface, looks good, but it's the devil in the details, and I don't think some of your potential applicants, pre-applicants, whatever, developers are ready to play at the level that the Canadians would expect. So I'd just interject some caution here.

But I think for both sides, if you define what you want in that license ability statement, then perhaps the staff has a better idea of what they're going to look for in that pre-

application material.

MR. BLEE: We do have a paper on this, we haven't released it publicly, that has some more detail.

MEMBER KIRCHNER: I've seen Commissioner Merrifield's papers, but I think it would behoove you, NIC, to have a little bit more depth here into what the expectations on both sides would be to get such a license ability statement.

MR. BLEE: As I said, we've got a paper on this. We haven't released it yet, but we are being asked about it by, you know, the Senate. So we will release it certainly. But I do agree -- by the way, in all fairness, some are going through that process in Canada because they're interested in the Canadian market in terms of really the smaller reactors. So it's not entirely that, you know, there's nothing here for them. Of course, you know, you've got TerraPower going to China because they said that the NRC process wasn't workable.

So the question is why --

MEMBER KIRCHNER: I don't feel I have to defend the NRC, but have they come to the NRC with an application yet to declare it's unworkable?

I'd go back, I had participated in the reviews in the 80s and 90s for both the mHTGR and the PRISM design, and I found at the time, although we didn't have the draft guidance that is expected to be released in the near term for the general design criteria, the staff at the time showed great flexibility actually in understanding the technology and why this particular set of requirements wasn't going to work and was adroit and flexible and adept in putting in, patching, actually, at the time, in real-time the standard review plan to look at those aspects of the design that weren't LWR-like.

So I think it's not fair to the Agency to say that so-and-so is going to China because it doesn't work here.

MR. BLEE: Well, that's a statement of fact. I mean, I don't know it's unfair. It's simply to say --

MEMBER KIRCHNER: Well, that's their business decision, but it's not a proof that the NRC system would not accommodate that design because my experience base is that they did in the past with the two earlier designs.

MR. BLEE: That's the perception,

though. That's certainly the perception.

MEMBER BALLINGER: So you basically have what amounts to two semi-moving targets. The Canadian process is sort of fixed but not quite, and you'd like to see that changed, and then get convergence between their process and what the staff here would expect with respect to an initial application, the quality of an initial application? Is that what I'm -- by the way, CNNC is the China National Nuclear Company.

MR. BLEE: I'll have to blame that on Jeff then.

MEMBER BALLINGER: I think it's CNSC.

MR. BLEE: CNSC?

MEMBER BALLINGER: CNSC.

MR. BLEE: Okay.

MEMBER BALLINGER: So is that the scheme? They have a predictable process?

MR. BLEE: I don't want to get too hung up on the Canadian process. That's not the panacea. As I said, it represents surety, it represents fixed price --

MEMBER BALLINGER: Surety, fixed price. So you get a product --

MR. BLEE: And you get something at the

end of your two years.

MEMBER BALLINGER: -- to be what you want so that, if you were to come to the staff, they would be happy.

MR. BLEE: And hopefully it would be something that would be useful to the NRC as you then move forward to the next phase. And what's the next step?

CHAIRMAN BLEY: I'm sorry to have created this big diversion. You can go ahead with your presentation, where you were headed. We need to move.

MR. BLEE: Okay. I'm almost finished, I think. So in terms of the, you know, the medium/long-term IAP, again, very logical framework. We recognize that the NRC is steadfast and is ready to accept an advanced reactor design for review, so we'll take them for their word. They will be able to test that soon enough.

Page three of the IAP repeats the NRC being ready to effectively and efficiently regulate and, review and regulate non-LWRs by not later than 2025. And, again, that's about a six-year delta between what has been stated by Terrestrial.

So I wouldn't call it lack of

timeliness, although I think Jeff has that in here. It's, basically, it's a matter of beginning with the end in mind and, again, responding to the market. But, clearly, we think the goal posts are moving forward, rather than moving backwards, and I think in terms of the advanced test reactor, I think that, thereabout, what you have there in your presentation, Jim.

So in terms of the fee requirements I mentioned before is basically providing fee release off the fee base, and I don't expect that this group would take the lead on this. This is something that the Congress is looking at is off the fee base in terms of allowing more interactivity in the pre-licensing engagement and the NRC readiness, and the NRC has recognized that by asking for the $5 million.

That doesn't address the fee issue. We have one free meeting, as I understand, and then after that you've got pay $260 an hour. So we think that there should at least be either off the fee base to a maximum extent and then possibly, what the DOE does is an 80/20, 50/50 kind of fee base just in terms of cost share.

CHAIRMAN BLEY: You're right. It's not

where we work. But in fairness, they can't do much unless they get money from somewhere, and they can't use licensees' money to look at these new things. They've been reined in in that area in the past. So there needs to be an off-fee source of funds if they're going to do that.

MR. BLEE: So in closing, I'm not taking issue with the Congress of the United States, just for the record. We should very much support that legislation. I really appreciate you all holding my feet to the fire here today and the good back and forth.

I would really encourage this group to meet in the same kind of format at least every six months. We really got to keep the velocity going. I think the NRC staff is doing a great job. Every six weeks they're putting us backwards and forwards in terms of meetings. There's multiple things going on at the DOE. It has been a sea change since a year ago in terms of activity, and it's a multi-ring circus. And welcome to the fray.

And based on what I've heard today and seen, we appreciate your involvement here.

CHAIRMAN BLEY: Thanks very much for your presentation. We're going to take a 15-minute

break. We'll be back at 20 until four on that clock.

(Whereupon, the above-entitled matter went off the record at 3:25 p.m. and resumed at 3:41 p.m.)

CHAIRMAN BLEY: The meeting will come to order again and we are now going to hear from NEI, Michael Tschiltz. Thank you, Mike.

MR. TSCHILTZ: Thank you, Dr. Bley. I'm happy to be here this afternoon.

MEMBER REMPE: Why?

MR. TSCHILTZ: Why?

CHAIRMAN BLEY: That's all right. We had a little go-round on that already.

(Laughter.)

MR. TSCHILTZ: So you'll be glad to know that I know nothing about Canadian regulations, other than --

CHAIRMAN BLEY: You may be too.

MR. TSCHILTZ: Other than I went fishing there once and I can assure you the fishing regulations are very complicated, as far as what you can catch and keep.

CHAIRMAN BLEY: Otherwise, they keep you.

MR. TSCHILTZ: That's right. So I'm here to provide NEI's perspective on the near-term implementation action plan, and we basically solicit comments from our members and specifically the Advanced Reactor Regulatory Task Force on this issue. So we've submitted our comments via letter to the staff earlier this week, with specifics and details.

I will say in general that there's no significant issues that are raised in those comments from the industry on the near-term action plan. I've got some issues in here that get into the detail, but I think we'll be able to work with the staff on those issues.

So I think that the action plan improves the transparency of the NRC activities and keeps the industry abreast of what's going on inside the NRC. Our goal and objective, at least from my role is to have the IAP actions result in a more effective and efficient licensing process for advanced reactors.

In reading through it, I think there's a lot of effort that's gone into it, and but I think the real benefit will be realized when we get into Phase 2, which is getting into the detailed

activities and trying to integrate the time lines and identify the critical path activities and allocation of resources to the different activities to make sure things are done in a timely manner that supports what people need.

CHAIRMAN BLEY: I didn't notice it in your slides, and it might be there. But you guys must be developing some guidance for the industry to coincide with these action plans at the NRC or --

MR. TSCHILTZ: I wouldn't say it's a one for one type of thing. We have, if you go the next slide, Peter. So I put this on here. You may have seen this before. This kind of depicts what the industry organization is for dealing with advanced reactor issues.

There's new plant advisory committee that's kind of at the C&O level. There's a coordination group which involves Southern, NIC, NIA, NEI and INL as well, that kind of basically is an information-sharing group where we try to coordinate activities.

But most of the regulatory issues work down to the Advanced Reactor Working Group, and it's probably a good time for me to explain. My

role has changed since I was last here before you. I was the Director of Risk Assessment and I was asked to take responsibility for new plants, SMRs and advanced reactors.

In the NEI reorganization, we've split into two different parts that deal with advanced reactors in the plants and SMRs. One part of the organization deals with commercialization, and the part of the organization that I'm responsible for deals with the regulatory and licensing issues. So I'm the principal interface for NEI on new plants, SMRs and advanced reactors.

CHAIRMAN BLEY: Now you used all these various boxes here, these task forces and things. They aren't all NEI or are they?

MR. TSCHILTZ: Yes, they are. They're all --

(Simultaneous speaking.)

CHAIRMAN BLEY: Okay. So everything is in NEI. It's all within NEI, okay.

MR. TSCHILTZ: Yeah. There's a plethora of working groups and task forces.

MEMBER CORRADINI: What's the difference, since you have them separated?

MR. TSCHILTZ: The working group is a

upper, higher tier level organization. The working group may have a number of task forces underneath it. The working group from --

MEMBER CORRADINI: So one works and one adjourns?

MR. TSCHILTZ: Well, one kind of directs what things need to be done, and that's when the task forces are formed and they create the product then that goes back up the working group.

MEMBER CORRADINI: So the task force has a charge. They complete the charge, the task force is dissolved?

MR. TSCHILTZ: Yeah. Each of the task forces will have a specific charter, and once they fulfill that charter you'll do away with the task force, although that often morphs into a new, different activity so --

CHAIRMAN BLEY: And within your language, you have a policy issues team I see. Is that -- do you mean the same thing by policy issues that the staff here means, or is it something different?

MR. TSCHILTZ: Yes. I mean it's the same thing, and in fact many of the -- I mean many of not all of the issues that Amy covered in her

slide or on a similar tracking document that we have that follow those issues as well in what we need to do to help move forward in those specific areas.

But the other thing I'll point out on this slide is where Amir's effort with the Licensing Technical Requirements Modernization Project fits in. So that's how this gets drawn into that. The advanced reactor technology task force is run under the commercialization side, and actually we make sure that we have representation from each of the technologies on the regulatory task force to make sure when we review documents such as the draft reg guide for the advanced reactor design criteria we have comments reflective of all the different designs that are being contemplated.

MEMBER SKILLMAN: Mike, let me ask this. Among those ten groups, how much overlap is there of individuals from one group into another group, and other responsibilities that the individuals that are in those groups have to other assignments in NEI?

MR. TSCHILTZ: Well, it varies. Like for example, I'm co-chair of the Advanced Reactor

Working Group. We're at Redmond now. I lead the new plant working group. I'm the chairman of that. Katie Austin, who works for me leads the advanced reactor regulatory task force, I think with Amir as well on that as the co-chair.

So you know, I know Peter's involved in some of these activities here with the staged application review and approval. So there's, you know, there's a limited number of people who are actively involved. I would say the Advanced Reactor Working Group, we have around 60 people come to those meetings. So there's a lot of interest in it.

When it gets down to doing the actual work, there's a smaller group of people that are actually involved with that.

CHAIRMAN BLEY: We had a little slide thing going on. I'm assuming most of the people on these groups or committees or task forces are utility people who are working part-time on these projects. Or are they NEI staff or is it just a mix?

MR. TSCHILTZ: I would say there's a mix. I mean from the different vendors that are contemplating, from NIC and NIA, from Southern.

INL's involved. So I have very limited experience. These two gentlemen can probably better answer that question than I can so --

MR. HASTINGS: Yeah. The short answer is there's utility directors entered as developers of the other organizations. There's typically one or two NEI staff assigned to each group, and then they'll come and go as the subject matter dictates.

CHAIRMAN BLEY: Developers has become common language now I take it. We heard it first and then I hope there's still designers involved.

MR. HASTINGS: Yes. They do design and development.

MEMBER REMPE: For a while, I thought I saw that NEI was promoting the use of technology-specific advanced reactor groups. Are you still doing that so that you might be able to have some cohesiveness among the 60 organizations proposing different designs?

MR. TSCHILTZ: Yes, that there are specific technologies, specific groups for molten salt, fast and HD, high temperature gas reactors. So there's specific groups working on those issues.

MR. AFZALI: If I may, first getting back to your questions. Everybody in the blue box

is under Part 10, non-paid guys. So there's no paid individual other than NEI guys on the blue boxes. The red box at the bottom, that's the project. We are doing it as a paid consultant groups working with that.

On the middle range, we've got Advanced Reactor Technology Task Force. That divides into three major design, high temperature, gas, sodium and molten salt. But they coordinate through Advanced AR Technology Task Force, and anything to do with regulation goes to the Advanced Reactor Regulatory Task Force.

So we're trying to coordinate as much as we can through NEI, and we're trying to create and then the red one on the top is trying to get coordination with NIC and NIA and INL, to make sure you have one voice in what we are asking for.

We have a saying in our company that the toughest part of the -- parts of the, any project is starting it and finishing it. We are in the starting point of that, so we have a lot of challenges. But we are moving forward, I think, in the positive direction.

CHAIRMAN BLEY: Thanks.

MR. TSCHILTZ: So the next slide. So I

think we've talked about this earlier during the meeting, that the importance of the near term activities is to align design research and regulatory processes, identify policy issues and gaps and figure out how to deal with those. Obviously, you know, the staff went over the policy issues, security and emergency planning. Current policy issues that are up front with the SMRs, and you know, those issues carry over to the advanced reactors as well.

One of the other things that we're advocating is placing a high priority on development of design-specific licensing project plans. We're ready to start an effort at NEI to basically build a template for those pre-application project plans. So there's -- it would be a common understanding and we think it would be helpful for the developers to have a better understanding of what they should be trying to get out of their interactions or expecting to get out of their interactions with the NRC.

CHAIRMAN BLEY: A question here. On your previous slide where we have all the boxes, the people on those committees or whatever we call them, are some of the -- and there's a plethora of

small groups who are starting to come up with designs, developers. Are they actual participants or are they represented by NIC and the NIA?

MR. TSCHILTZ: They're participants.

CHAIRMAN BLEY: They are participants themselves, okay.

MR. TSCHILTZ: Yes. Okay, so the next slide. So I think when I looked at the implementation action plan, my comments were all the ones that were most important to me were on Strategy 3. It may align with what my responsibilities are at NEI. To me, the technical issues, although there may be a longer time line for working those out, I think those are more straightforward.

The issues where I think where we're going to have the greatest benefit out of this is trying to figure out a more efficient and effective licensing process, and that's where Amir's project fits into that.

I think we're advocating that we can license these first tier at least of the advanced reactor designs that are being contemplated right now using the Part 52 or Part 50 process that's informed by the advanced reactor design criteria,

in combination with what Amir's working on for the licensing basis event selection.

So I think it's a workable process, and we're supportive of moving forward with that in the near term. So I guess Amy mentioned about a *Federal Register* notice that is going to be issued here I think next week on advanced reactor security. I think we're in line with that.

I think when we initially read the plan, the draft plan, we thought that it needed more detail in that area, and I'm thinking that between NEI's white paper that the NRC has accepted for review and we got a fee waiver earlier this week on, we'll start those interactions and interact on what's in the FRN so we can move forward with that.

So I think we're aligned with the staff on how that fits into the plan. I think our initial comment was there could have been more detail on that, and it looks like we're headed in that direction.

Next slide. So I think the staff alluded to the fact that we've had discussions that we think that some fuel issues should be included in the near term action plan. We've had

discussions of whether there's any specific policy issues or gaps in regulation.

None really readily jump out at us, but I think it warrants more detailed, in-depth dive into those areas, to make sure that, you know, all of these areas are covered and if there are any policy issues that emerge out of this, it transcends across a number of different disciplines, which makes the conversation harder.

So I think the staff is receptive to that feedback and we'll be having that dialogue as we move forward.

MEMBER SKILLMAN: Mike, does that -- does that approach remove existing enrichment facilities from consideration, by going from five to 20?

MR. TSCHILTZ: So I don't believe there are any enrichment facilities currently licensed to enrich to 20.

MEMBER SKILLMAN: Oh, they're not?

MR. TSCHILTZ: They're eliminated.

MEMBER SKILLMAN: Fine. My question if you go to 20, are there some that cannot participate because of the staging and geometry of the centrifuges, other design issues in those

plants?

MR. TSCHILTZ: I don't know the answer to that question. I do know that there is one entity out there who has the capability to build and would build if there is a market for that material. So --

MEMBER POWERS: As far as I know, there is not an engineering challenge, that it's market-driven. As to the challenges we have on enrichment is about five percent on neutronic and on uncertainties in cross-sections, and they get worse when you talk about soluble fuels and things like that.

Now most of those issues have been hanging around for 20 years that I know of, and yet the capability to resolve those has degraded badly in the United States, but it exists overseas and it seems to me that that's one where a great deal of international cooperation can be fostered and in a short time reduce that particular issue. Maybe NEI is in a position to facilitate.

MR. TSCHILTZ: So we have this discussion at NEI. You know, a lot of the issues kind of bleed over into commercialization issues here. Not so much all of -- all of them aren't

just in the regulatory and licensing area. But there's an example. Like for example the UF6 canisters. They're licensed to have up to five percent enrichment, I believe. There's no -- and the way the transportation regulations are written there.

So there's no alternative to that. The alternative would be to deconvert the metal, transport and then manufacture the fuel at a different location. So there are some issues and potential obstacles there. So really to think through that, I think, and to see if there are any regulatory or policy issues that come out of that. I think that's what we're advocating.

So the next item is the regulatory review road map, and one of the issues that has come up as a result of our experience with design certifications is the level of detail that's been expected, has expanded over time. So we're looking to basically enhance the guidance for what the level of detail would be needed in an application, what level of detail is needed for an acceptance review, and the industry has a group that's starting to work on this.

So I think our next step would be to

draft a white paper, and I know the staff is also working on a revision of Reg Guide 1.206 and the standard review plan to address some of these issues as well. So we're coordinating on those efforts.

Next slide. I guess my presentation is short. We're --

MEMBER RAY: Let me extend it just a little bit here. We've had -- we have a certified design. I happened to chair the subcommittee, and we've had to process some exemptions recently, and we just had a presentation from staff on the lessons learned from those exemptions, in terms of the process of review and adoption, issuance of a design certification.

Has any of that been taken into consideration when you talk about what level of detail is required for the future applicants?

MR. TSCHILTZ: So let me see if I understand your question. Are you referring to what happened with the delays in the COL, the issuance of COLs based upon errors in the DCD or --

MEMBER RAY: No, I don't know anything about delays in the COLs. I'm just talking about exemptions that we processed for and what were

found to be -- by the COL owners to be omissions in the application of Appendix B during the design certification development.

MR. TSCHILTZ: So --

MEMBER RAY: At least that's what they said and that's what we accepted.

MR. TSCHILTZ: I will say --

MS. CUBBAGE: This is Amy Cubbage. Those were the certified, the Westinghouse certified design issues, the condensate return, etcetera, etcetera, that were -- had to be addressed by Levy for the license.

MEMBER RAY: So I'm basically asking, we have some experience to go on terms of details that weren't included in the design certification and then subsequently were found to be problematic and required changes in order the plant to operate as it was --

MR. TSCHILTZ: So let me see. Amy's clarification was very helpful to me because so my understanding is the issues were addressed through departures in exemptions, which allowed them to -- the staff to move forward with issuance of the COLs. We actually have --

MEMBER RAY: Somehow actually existed,

but that's a detail.

MR. TSCHILTZ: Okay. So we have a legal advisory team who is actually looking at this issue, and developing options as to what, how we should proceed, whether we should have a petition for rulemaking, whether we should seek some other clarification from the NRC. I think that one of the proposed mechanisms --

MEMBER RAY: Clarification about what? I'm sorry.

MR. TSCHILTZ: How to address these issues in the future, because one of the issues or one of the proposed solutions to this was issuing I think license conditions and I know OGC had took exception with that, as granting approval based upon a future action.

MEMBER RAY: Yeah, but that has to do with the process -- the processing time and the methodology, the regulatory process that you would use to address the issues. What I'm trying to have you talk about, because you had talked about guidance for what level of detail was required for the certification applicant, not the COL holder.

You know, you can reduce the level of detail on some continuum. At some point, though,

you're trying to -- it won't do what you said it would do and you then need to do something to revise the certified design, because if you build a certified design, it simply can't be operated.

MR. TSCHILTZ: So I would say the way I would answer your question is that there are certain aspects of the design that warrant more reviews than other aspects of the design, and I think what NRO has done with this safety focused review kind of has people spend more time on looking at those areas that are most important to safety and less time on other areas.

So I think where this would fit in would be those areas where there's less time. There may be less required for your submittal.

MEMBER RAY: Well, one of them was, for example, heat load in the control room. They found that you couldn't be without power in the control room for as long as they said in the design certification than you would need to be. You know, one cure of that is just not say how long you're going to be without power in the control room, and that's what I'm trying to get to.

As you get at a high end of -- if you get few enough details, then it's pretty hard to

violate anything that you've certified because there isn't any detail there. In this case, there was a provision that required -- that you would be able to occupy the control room for a certain period of time with a loss of all power, and they couldn't do it because the heat level is too high. That's the kind of detailed, don't you think?

MR. TSCHILTZ: Yes, but I think -- I think you could make the argument, and the staff probably has made the argument that you would need that level of detail to come make a safety conclusion. But for other things that are in the 19 chapters or whatever, maybe you don't need as much detail.

MEMBER RAY: Okay. There are some things like maybe the, I don't know, the color of the control room door. I don't know what it would be, something anyway, that you don't need.

MR. TSCHILTZ: Yes, and I think the safety-focused review kind of highlights the fact that, you know, the staff is going to focus most of its resources in certain areas, and you would expect more detail in those areas and maybe not as much in others.

MEMBER RAY: Okay. I don't want to

hold you up any longer. Go ahead. I just didn't think -

MEMBER KIRCHNER: Actually, I wanted to join in, Harold.

MEMBER RAY: What?

MEMBER KIRCHNER: I wanted to hold them up a little longer.

MEMBER RAY: Well all right, but I just couldn't under -- I wasn't sure we're just talking about reducing the level of detail required or being maybe more specific. I'm not sure. The SRP is pretty specific right now, but anyway. All right, thank you.

MEMBER KIRCHNER: So here likely you refer in the first bullet under 3.4 that the expected level of design detail required -- now these are evolutionary plants that they -- that the NRC has looked at for design certification. They're mature designs benefitting from 50 years of operation, etcetera.

But now we're going to advanced reactors that are going to start off as one of a kind. So I'm just intrigued. So it looks like the intent is to get a design certification for these advanced designs? Then it begs the question at

each step along the way in a phased review, what would your recommended -- NEI, what would you recommend to your stakeholders as what should be included?

Say we take David Blee's suggestion we should do something like the Canadians, and get a licenseability statement. What would you expect to be in the application to get such a statement? Have you defined that as a group?

MR. TSCHILTZ: So as I --

MEMBER KIRCHNER: A surety at each phase of this proposed phased review process?

MR. TSCHILTZ: So actually I don't think we're, at least initially, are coming at it from that angle. We're actually coming at it from the review of the Reg Guide 1.206, an update of the SRP and some other guidance document that I think we are looking to basically develop the white paper that would form the basis for that, that would get into more of level of detail and what's required for the specific level of detail. So we, at least in my mind, I haven't married it to the staged design review process.

MEMBER SKILLMAN: Mike, I need to make this comment. The work that I've done on design

certs is work where the team kept 50.9 and 52.9 in front of themselves constantly. If you read that, that little grouping of words basically says, basically communicates this submittal will be materially accurate in all aspects under, if you will, throw out a perjury, and it's got to be signed by an officer.

And so at least one of the teams I was part of heeded that, and that is in 50.9 and 52.9. It basically communicates you've got to tell the truth, the whole truth and nothing but the truth. You've got to write it down, and if you find something that's not what you had represented it to be, the obligation is on the designer to go back and say "time out." I've got an error.

But I would just bring that to your attention. If the goal here is to have a design certification, it may be prudent for those who are involved to review those very small sentences in 50.9 and 52.9.

MR. TSCHILTZ: I appreciate that. I don't think anyone has any intent to reinterpret or try to change any of that. I think those are good regulations.

MEMBER KIRCHNER: Obviously those are

obscure, and until those have been pointed out, there are folks that say gee, I didn't even know that was in there.

MR. TSCHILTZ: So I think maybe an example that would maybe highlight some of the issues associated with level of detail would be if you have a small advanced reactor, you know, very small power output versus something like an SMR. Say SMR was a 12,000 page submittal to the NRC, but for a small, smaller reactor, a different technology, what would be the appropriate level of detail for that?

What that be required a 12,000 page submittal, or would that require something much less? So because if you take the concept that the ability to affect public health and safety is much less, then the safety decision can be focused on specific aspects of the plant. Then maybe you wouldn't need to have a 12,000 page submittal.

MEMBER KIRCHNER: Michael, that's the domain of things we used to do at the lab, small reactors and yes, of course, the amount of paper work is lot less than a large, complex nuclear power plant. Is that your real customer base?

MR. TSCHILTZ: So that --

MEMBER KIRCHNER: I know --

MR. TSCHILTZ: There's a full spectrum. There's a full spectrum and one of the --

MEMBER KIRCHNER: Wait a minute, wait a minute, wait a minute. Yes, I know the forest design, I know all this. Are we going to -- it seems to me there are mechanisms like test reactors to encompass those kind of outliers. We're not going to power this country on less than ten megawatt reactors in any foreseeable economic way in the future, right?

I mean really it would seem to me your focus, especially because the utilities are such a large part of your organization, would be on making, you know, power at scale 24-7, highly reliable and that is 1,000 page application or whatever number you want to put on it.

It's not a small conceptual design effort and something you go and build in the Polyrito site at Los Alamos. We can't do that anymore, but I did that once. So while you're bringing that one --

(Simultaneous speaking.)

MR. TSCHILTZ: I mean the point is this one size doesn't fit all. There's a whole spectrum

of what's out there. The example I gave is a real example. They're NEI members. They bring the same thing to the table that other people bring to the table. There's a number of designs in between those power levels. So to me, it's worthy of a discussion and some more thought --

MEMBER KIRCHNER: You already say one size doesn't fit all, and it seems to me anything in the test reactor category ought to be just dealt with differently. I mean that can't be the test vehicle for a 500 megawatt plant. It's not even a prototype of a large commercial plant.

MR. TSCHILTZ: I think you base your level of detail based upon first principle pipe concepts of how you come up with your safety decisions. So you know --

MEMBER KIRCHNER: Realistically, what are you asking? You want an effective timely response from the NRC with a certain degree of certainty, I'm repeating my words. I mean those are some of the attributes you're looking for in the regulatory process. Why do you want to complicate it with a less than ten megawatt small reactor for --

MR. TSCHILTZ: I think you're going off

and misinterpreting what I said that we're focusing our efforts on these small reactors. It was only an example of that.

MEMBER KIRCHNER: Well, I think it's a bad example.

MR. TSCHILTZ: Well, it represents the spectrum of what's out there.

(Simultaneous speaking.)

MEMBER KIRCHNER: Of course it does, but for commercial power --

MR. TSCHILTZ: -- and that the level of detail that's required in submittals has grown. We think it's time that we need to address it. We're willing to take action in the industry, to come up with improvement in the guidance that would allow us to do that. We plan to work with the staff on it.

We know the staff has ongoing efforts to revise the SRP and Reg Guide 1.206. We think it fits in well with that. We know there's issues with level of detail required for acceptance reviews. We've seen it with the past two applicants. So those issues are real and we think we need to address them.

MEMBER KIRCHNER: I agree, but looking

at a small test reactor is not a good vehicle for that.

MR. TSCHILTZ: I'm not saying that we're going to look at it. I'm saying that there's a range of applicants out there. I think you understand what I'm saying.

MEMBER REMPE: But Walt, again I think he said a small reactor. I don't think he said the word "test reactor." He's talking about a small reactor that produces --

(Simultaneous speaking.)

MEMBER REMPE: You can't use the test reactor, the way the regulations are is my understanding, right?

PARTICIPANT: That's correct.

MR. TSCHILTZ: Right. They will be a Part 50 or a Part 52 application.

MEMBER KIRCHNER: I understand all that. But it would seem to me that you would be focused on these call them mid-size, call them SMRs whatever, and that size reactor is going to require a lot more detail and the application is going to have a lot higher page count, etcetera, etcetera, etcetera.

I'm just objecting to bringing that in.

I can't -- yes, you have a lot of customers and such but --

MR. HASTINGS: If I may, I think the point of this bullet is that it's consistent with the staff's safety-focused review of NuScale as an example.

MEMBER KIRCHNER: Okay.

MR. HASTINGS: It should be a right-sized application. The requirements should be predicated on the hazard of the facility for public health and safety, and the fact is when we did AP1000 and I was right in the middle of that as well, we didn't recognize at the time we were finalizing the DCD that we were writing a construction compliance document.

The industry has recognized that as a lesson learned. The staff recognized that as a lesson learned. The prize was the design cert, and so when an RAI would come in, it was a lot easier to put the detail in the application because that's what the reviewer wanted.

Then to think ahead to how difficult it was going to be to try to construct that document. That's primarily what this bullet is about, I think, is getting the right level of detail, enable

the staff to make their safety finding without encumbering the application with more detail than is necessary, irrespective of the size of the plant as a function of the risk. I think that's the goal.

MR. RECKLEY: Have you put out some guidelines as to what you think is the right level of intent?

MR. TSCHILTZ: No. As I indicated, that's a -- it's a project that we're starting on, and we're starting -- we're going to interact with the staff. I talked to Frank Akstulewicz not too long ago on their -- concerning their efforts in revision of the reg guide and update of the SRP.

MEMBER REMPE: Today, I've talked to several people about the need to review the quality in the processes, irrespective of the size of the reactor. Has that -- I mean you've talked about the fuel issue and how that was important at NEI. Have you started trying to talk to some of your members, that it's important to think about as they develop their design, if there needs to be some sort of quality and peer review in their process?

MR. TSCHILTZ: So I can only answer that from the perspective of the people that I've

dealt with to a large degree. With certain exceptions, our people that have 30 or 40 years of experience in the industry working on these issues, they're very familiar with the quality requirements. I would say those few that don't fit into that category, they have people involved with their project who do have that experience.

So I personally don't have a concern that there's a big gap out there between what ACRS would expect or the staff would expect for the quality of the application and what people are actually working on.

MEMBER REMPE: But you heard me refer to this *Technology Review* article, where there was a gap in the quality and so again, I don't know how many of them have done things internally to ensure that there's necessary --

MR. TSCHILTZ: I'm aware of the issue. I'm kind of aware -- I'm not exactly aware of where they were in the process of developing the conceptual design and progressing along that line. Obviously, they haven't gotten to the point where they're starting specific interactions with the NRC so I mean --

MEMBER REMPE: I just am curious on how

prevalent this is among the almost 60 groups and concerned about that.

MR. TSCHILTZ: Yeah. I would say my experience is we don't have a lot of interaction with the 60 groups. There's a subset of those groups that we have more frequent interactions with.

MEMBER REMPE: Thanks.

CHAIRMAN BLEY: Anything else? Okay. It's time to move to Amir's side. Thank you for being here. Thank you, Michael. Go ahead.

MR. AFZALI: Okay, thanks. While they're getting the presentation ready, I have a pre-written script that I'm going to go through that I want to make a couple of points. First, I want to wish Happy International Women's Day to all our colleagues here. I'm wearing a red tie in your honor.

CHAIRMAN BLEY: Oh, is that what the red's about?

MR. AFZALI: Yeah. It is Happy International Women's Day.

CHAIRMAN BLEY: Is that why Joy is --

MEMBER REMPE: God no. We don't get the news in Idaho.

FP I think as women we're supposed to be on strike, but we chose to come in today.

CHAIRMAN BLEY: And just so we're clear, without you we would have been dead in the water. So thank you.

MR. AFZALI: And if you'll notice I've got my tie a little bit loose because all the heat in the room. Secondly, as the presentations are going on, I heard a number of references to our project, so I'm kind of --

I'm very flattered by all those mentions. I'm hoping that they don't set me up for a heated discussion of that project, because what I'm going to be talking about is why we established that project and what the deliverables are, how we're doing it. So the conversation hopefully is going to be beneficial to you.

With that said, again my name is Amir Afzali. I'm Southern Company's Licensing and Policy director. When I say "policy," I'm not talking about licensing policy, regulatory policy. I'm talking about energy policy for advanced reactors. Thank you for affording me the opportunity to provide you with our perspectives on advanced reactor licensing.

The title of my presentation is "Removing Barriers for Advanced Reactors Development Through Modernization of Regulatory Framework," and I know we'll have a lot of discussion what is modernization. Hopefully we can discuss that through the presentation.

We believe this modernization is important to achieve utility, utilities going off continuous performance program. When there's objective of being to innovate, industry's and NRC's objective of continued safety improvement and collective goal of reducing cumulative effect of patchwork regulation.

Next slide. So during my slide, again I'm going to talk about our observations and the basis for those observations, and finally what we are calling a proposal to close the gap in what we see as a gap in our current regulation.

So after this morning's interactions between the ACRS and the NRC members, I feel that a lot of points have been made already, but I hope the reason why we think that's the best way to go forward is helpful in this conversation.

Next slide, please. So let me start with our observations. Now IAPs are comprehensive

and highlight many different pieces of the puzzle that have to come together to remove the licensing as a barrier against nuclear fleet modernization. Also, the extensive nature of the IAPs override acknowledgment of the challenges that are faced by our vendors and our innovators.

The acknowledgment, although not sufficient, is an important step for the final conclusion. On the other hand we believe, as presented, the deliverables from these activities, the interconnection within the deliverables, priorities of the deliverables, and how these deliverables result in a timely improvement in effectiveness and efficiency of licensing process are not yet clear.

I am -- the strategy I'm outlining here is to develop not a piecemeal competency improvement but a holistic approach to improve license. Finally, although the need for risk-informed performance-based licensing structure for advanced non-light water reactors was identified many years ago, 1990's, and has been emphasized recently in SECY-15-0168, yet the projected time lines of developing risk-informed performance-based are well into the future, 2026 time window.

So when you're talking about can we do it quickly enough, they have been talking about this for a long time and it's time for action versus continuous conversation.

Next slide, please. So what is the basis? Where does our observation comes from? The basis of these observations are developed based on our experience with licensing and building first of a kind generation reactors at Vogtle plant, our MOUs with advanced SMRs developers like NuScale, our MOUs with non-light water reactor developers of more mature designs like GE, X Energy and AREVA, as well as working with developers of more ground-breaking technologies such as TerraPower's Northern.

Our observation and actions are influenced by collaborating with NRC and risk-informed performance application for the current fleet, e.g. we helped with the 50.69 development and exercise, as well as collaborating with NRC on its Level 3 PRA study. Finally, our observations are based on our work on needed energy policies to support advanced reactor research and development as well as deployment.

Next slide, please. So this is a basic

time line we put together to show from concept to actual final commercial plant what it takes, what are the steps, the general steps, kind of phases of development. As we can see, billions of dollars, billions of dollars are necessary to get -- take it from the concept all the way to commercialization.

Obviously, some of the reactors are at different phases of this, but all of those, they need billions of dollars for development. We believe it is unreasonable to expect these, the public and private sectors to time to lift this heavy lift given the current uncertainties in regulatory framework.

Therefore, we believe a clear and effective framework has to be in place as soon as possible to remove the regulatory uncertainty barrier for investment.

Next slide. So again, to summarize our basis for the need for timeliness observation. We believe that varying national and international interests and needs require the portfolio of energy solutions. However, substantial investment over many years are needed for research and development.

Technical, financial and regulatory uncertainties are major barriers for enabling these

investments. We are dealing with both technical, financial and the regulatory uncertainties, and having a modernized regulatory framework is paramount in reducing the regulatory uncertainties. Next slide please.

MEMBER KIRCHNER: Could you just enumerate in roughly in order of importance what those barriers are?

MR. AFZALI: Barriers, which? The licensing barriers or --

MEMBER KIRCHNER: Sure. Start with those.

MR. AFZALI: Okay. So if you don't mind, give me two minutes and I'll get to the slide that may cover that, and if we don't get there, then ask that question again.

(Off mic comments.)

MR. AFZALI: Okay. So the next slide I would like to present is based off our observations regarding the need for a holistic and coordinated plan that prioritizes work needed to transition to a system that will be technology-inclusive, risk-informed, performance-based regulation.

As shown in this slide, in general based on pressure and temperature, reactor

technologies fall into four major categories. They have been developing prescriptive regulatory framework for their light water reactors for over 40 years. Also, many successful risk-informed performance regulations for the current fleet have demonstrated we can do better.

Therefore, duplicating the same prescriptive approach for other technology deliveries will take too long, require considerable resources and production would require -- requires backfit and risk-informed performance-based approaches in the future.

Finally, due to resource consideration, trying to repeat our prescriptive approaches may force us to down-select resulting in promising technology to be neglected simply due to licensing uncertainties.

Next page. So our conclusion is that we believe a technology-inclusive, which enables or incentivizes innovation across a broad spectrum of advanced reactors is necessary.

We believe it has to be systematic risk-informed to facilitate systematic and robust consideration of the risk to the public during design and licensing, and it has to be performance-

based to facilitate clear and the context -- to the extent possible, direct relationship between the performance and licensing requirements.

CHAIRMAN BLEY: Amir?

MR. AFZALI: Yes sir.

CHAIRMAN BLEY: What are your thoughts on how well these implementation action plans are moving us in those directions?

MR. AFZALI: I've reviewed those action plans quite deliberately and extensively, and I've had many conversations. So if I look at the action plans, they provide every bit of the jigsaw puzzle we need to get there. However, I believe trying to do everything we say in the action plan in a timely manner, it takes 20-30 years. I also believe --

CHAIRMAN BLEY: Can you break those apart? Is it all the strategies together, or is it primarily one of them that looks like it's piling up?

MR. AFZALI: Strategy 3 and 5 are 100 percent aligned with what we are doing. Strategy 2, where we're developing tools and perhaps is going to take a longer time. It depends on what you're developing the tools for.

If you don't know what is the licensing

basis and events election, what are you being licensed for, how and what accidents you are going to consider, it's going to be very hard to ignore and develop tools which can analyze that type of accidents.

So I think there's some order challenges in there and then there are some requirements challenges in there. So we believe both of those have to be addressed. I want to kind of answer that question within that context of our next slide, where we're going to say specifically what we're doing. Maybe that will answer your question a little bit more clearly.

CHAIRMAN BLEY: Well that was pretty good. I think you hit right on the things I was asking.

MR. AFZALI: Thank you. So next slide, please. Okay. So we talk about regulatory framework. Internally we decided to look at and tried to define what do we mean by regulatory framework. There's part of it which is the processes, Part 50, Part 52 or some other part or stage licensing. They all have location and process requirement. That's the way we categorize them or bin them.

We believe the current available to us, tool available was in this bin is adequate for near- term actions and licensing advanced reactors. The next level is the administrative processes. I know ACRS is a technical group, but I'm going to bin it under administrative processes, because we don't set requirement. We just review that for right guidance.

So we believe ACRS reviews in public hearings do not need to be modernized at this point. The next level is the licensing technical requirement. At the highest level, we believe Part 100 the safety goals and what the goals to the public should be like Part 100 requirements are adequate. We are not proposing to change or modernize those.

The next level of technical requirements are what you do to make sure you adequately protect the public. The first step and Jim provided that in his presentation, the first step in doing that, you have to identify what are the events that you're going to defend against, you're going to protect against.

There's no current process for doing so. There is no current systematic way of --

CHAIRMAN BLEY: Since the word "modernization" jumps into that step, is that primarily what you're looking at when you say NRC's process needs to be modernized?

MR. AFZALI: That's correct, because what we did for light water reactors, in my opinion, we developed based on a Naval reactor experience through many years of experience, and we decided what our licensing basis should be, right. We really didn't need a process to come up with that, a systematic process. So there's a gap there and that gap, we think we can modernize our regulatory requirements by developing a systematic process.

MEMBER REMPE: And you want more than the authority identified by the staff in Strategy 3, or you just think they can do it with their Strategy 3 they've identified?

MR. AFZALI: I believe as part of Strategy 3, the staff is working closely with us on our project. I think the combination is going to result in that modernization.

Previously, I'm not saying they were in agreement, but there was nothing to tell me they weren't going to do it. Does that make sense? So

it's not that I think there was a gap; I don't know you're going to close the gap. Now we are working together to close the gap.

MEMBER POWERS: I guess by your written language there, given that the agency has professed an affection for the probabilistic risk assessment methodologies, why would you not just use that to assess what are postulated events and the consequences you would protect against, provide adequate protection of public health and safety given that you accept Part 100?

MR. AFZALI: I want to make sure I understood your question before I answer it. So while I didn't provide an example of the process being provided today, which uses PRA information plus some engineering judgment to decide on licensing basis event selection, it is a process that we are advocating, as a process we are working to.

Is your question do you think that's where we should go? If that's your question, that's exactly where we think we should go. Did I answer your question?

MEMBER POWERS: Okay, I'll accept that. That seems to fulfill your systematic process for

doing it. The NRC has professed an acceptance for that approach. You're going to have to defend it, because they don't have for some novel design an accepted staff analysis for that design. But I mean it seems like it's just their charge. Go ahead. Knock yourself out.

MR. AFZALI: So what the process we are going forward with is developing a technology inclusive risk-informed performance-based process while identifying licensing basis events. We plan to submit that to the NRC and we're already engaging with the staff, reviewing our proposals.

We are hoping at the end of that we -- there will be ISG or some reg guide which endorses that approach, and then there would be a process that people can use to demonstrate the licensing basis events selection, SSC classification and defense-in-depth consideration.

I'm not sure that is not going to serve the problem or what is your question?

MEMBER CORRADINI: I think all he's -- I think you've answered his question.

MEMBER RAY: Then I have a question for him. Let's take the design basis earthquake event.

MR. AFZALI: Sure.

MEMBER RAY: How does PRA apply to that, in the way that you're describing?

MEMBER POWERS: Okay. I have to ask you why are you asking that question?

MEMBER RAY: Well, because I wasn't sure I understood your question or your hypothetical, the thing that you said "go ahead, have at it."

MEMBER POWERS: Why shouldn't they? I mean --

MEMBER RAY: Well I guess --

MEMBER POWERS: I can explore the seismicity of boron ring to locate this unit. If I'm not locating the unit, then I can take a generic application, much as we do now and assess the seismic vulnerability of the plant and the consequences of those vulnerabilities. I mean is there anything that I'm missing here?

MEMBER RAY: Well, I guess what I'm trying to understand Dana is whether if I have -- what the probability is we're talking about. That is to say, you know, I've got a spectrum of probabilistic seismic hazard analysis. I've got -- I can pick anything along that spectrum.

It doesn't have anything to do, though,

with the -- you know, I'd want to say I don't want to exceed this design basis event more than once in a million years or once in 10,000 years or whatever. That's the event itself, right. Is that what you're saying, is the way you would establish that particular design licensing basis?

(Simultaneous speaking.)

CHAIRMAN BLEY: I kind of think that we're trying to solve the problem for the industry and the staff, and I don't think that's --

MEMBER RAY: I was just trying to understand what was going on here and I didn't. So I'll -- we can talk about it later.

CHAIRMAN BLEY: I think that's better, yeah. Okay.

MR. AFZALI: So the second we're going to work on is adequate safety determination. We believe that's too subjective and is going to be a bigger challenge for non-light water reactor. So we want a risk-informed, performance-based SSC classification and difference in-depth consideration.

Again, we are working on the solution path so we'll be happy to come back to the ACRS and provide you with our solution path if you are

interested what the answer is. Right now we don't have the answer. The last part is design criteria to protect against postulated events.

So ARDCs. What we have done so far on ARDCs, joint DOE/NRC efforts will be substantially supportive of licensing advanced reactors and is definitely consistent with what we are doing as part of our project. So our project would be feeding into the criteria. Why do the criterion make sense? What are those criteria trying to defend against? So our project fits into that project nicely.

MEMBER KIRCHNER: Let me ask a couple of questions here.

MR. AFZALI: Sure.

MEMBER KIRCHNER: So picking up where Dana was, it sounds like you want to go -- typically you design a reactor from the inside out, and defense-in-depth is built into the design. It seems to me what you're saying here is that we go to a mechanistic source term and such, and we look at the consequences to the public and then we just design back the other way.

And with that, we identify events and then we screen them with PRA. I don't know how

you would do that without a good detailed design early on, but anyway we use PRA techniques and then we're going to determine which systems or structured systems and components are important to safety. Is that basically what you're saying, you're going to come at it from the outside in?

MR. AFZALI: That is consistent with the overall approach.

MEMBER CORRADINI: Well I think, I think the reason Walt's asking the question as he is is that there is a certain level of design detail you need so that when you do your risk-informed performance-based X or Y or Z, you know enough about the design that you can accept and uncertainty ranges in whatever you choose to be.

So if we go back to the -- whoever's presentation it was, I think it was Jim Kinsey's relative to what the frequency dose calculation might be, they had ranges. If those ranges are too big, then I can't make a decision. I need more details on the design. That's what I thought where Walt was going.

MEMBER KIRCHNER: That was part of where I was going, because I was coming to your next bullet, which is you say currently it's too

subjective. So how would you make it less subjective?

MR. AFZALI: Well I don't discuss how you're going to get it, but I'll give you an example. Currently Chapter GDC-17 says you need two outside power sources. For AP1000, we said we need -- we negotiated. We said we need one outside power source because there's a passive coolant.

For SMRs, with passive cooling we're then back to two outside power sources, and the reason given was that they need defense-in-depths. Now there's no definition of what adequate defense-in-depth. We want to work with the staff to have a clear performance criteria for defense-in-depth so we know what we're shooting for.

So don't know where NuScale is right now. Maybe they changed that again to zero or one. I'm not sure at this point, but that was -- as an example, we are not clear what the definition of defense-in-depth says, and therefore you have to negotiate what is adequate defense-in-depths.

MEMBER KIRCHNER: Well, I don't think it's appropriate to get into NuScale here as an example, but let me just follow up. You asserted that in AP1000, you were able to get to just one

backup power system, right?

MR. AFZALI: One offsite power source.

MEMBER KIRCHNER: Offsite power system right, and you're -- so why is the current determination too subjective? It seems to me that somehow, leaving NuScale aside for the moment, that the regulators were able to make a determination that given the passive cooling features of this design, that that was adequate.

MR. AFZALI: What is adequate? How did you measure the adequacy?

MEMBER KIRCHNER: Well how did AP1000 measure?

MR. AFZALI: It's just negotiated.

PARTICIPANT: No, it's just a negotiation.

MEMBER KIRCHNER: I don't think it's just a negotiation.

MR. AFZALI: If you look at every difference in the measure in my opinion, I mean it's not my opinion; this is the NRC position that there's no, as far as I know, there's no adequate definition of defense-in-depth. So we are trying to make that a systematically arriving at that.

How do you decide on what is adequate

defense-in-depth? I have not seen anywhere any document which tells you what is adequate defense-in-depth.

MEMBER KIRCHNER: I'll grant you that example, but please elaborate. How are you going to take the subjectivity out of this system? What's your plan? What mechanism, quantitative or qualitative would you propose that would reduce the subjectivity of these reviews?

MR. AFZALI: So again, we haven't got to the solution space yet, but during the NGNP project became -- they came into a solution where they talk about design, defense. You couldn't design defense-in-depth, programmatic defense-in-depth and then defense-in-depth, that we can come up with a table and based on that table, based on number four, based on a set of criteria to say if you have got one of this, one of this, one of this, it has adequate defense-in-depths.

MEMBER CORRADINI: But I don't -- I think we should let you go on, or unless you're at near the end. But I think Walt's biggest point is that you might come in with a potential goal as to what the fuel reliability is and what the primary system reliability ought to be and the containment

function.

But then you have to know enough of the detail of the design so that if the uncertainty is a factor of ten, that may not be acceptable. So if you call that a negotiation by staff, then so be it. Either I need to know more about the design detail, so that I can be more assured, or I have to develop, I have to demand for more margin in case my uncertainty is that large.

MR. AFZALI: I get what you are saying. That's a different question.

MEMBER CORRADINI: That's my interpretation.

MEMBER KIRCHNER: Well, I was just struck by your saying it's too subjective, and I just wanted to see how you proposed in a framework, in a regulatory framework sense, to make it less subjective. I'll admit your one example, but it doesn't provide a framework for deciding the next point.

MR. AFZALI: Again, I'm not trying to solve all the problems. Just another example maybe, maybe is for high temperature gas-cooled reactor, a confinement function. Is that -- is that adequate or do we want to put on top of it?

How do we make that decision?

MEMBER KIRCHNER: Well, I presume that in your approach you would use a risk-informed approach, which would start at the outside and work in, and then systematically look at whether you have sufficient defense-in-depth with your final design, such that you could tolerate say a single failure or something that was between, you know, the ultimate barrier and the public or some type of methodology. That's where I thought you were going with this.

MR. AFZALI: So that's --

MEMBER KIRCHNER: But the uncertainty for the -- the less mature the design going into this process, the less certainty. I think you would admit that, right? So you've got, you know, two classes of reactors with a fair amount of regulatory history in the gas and the sodium categories. Once you go to a liquid fuel, now you go into a different, a different world all together in terms of reactivity insertion accidents and such.

And so before you have a really good design, the regulator I think would approach that with some healthy skepticism about how this system

is going to perform, and the uncertainty bands, whether it's in PRA space or whatever, are going to be larger for a system like that.

So there is inherently some subjectivity. I was just struck with that and I was thinking well, from a methodology standpoint or a regulatory standpoint, how am I going to take out this subjectivity?

MEMBER CORRADINI: But if I might just, so we may need to move on. We're having too much fun. Dana handed something than ran away. But if I take you back 40 years, go to Clinch River, right. They had a particular core design. That particular core design had inherent energetics.

So the Commission came down and said thou shall consider a core disruptive accident of an energy release of as much as X, and until you can show us that it's below X mechanistically, you will follow X.

That's subjective, but the Commission did it because from a health and safety adequate protection standpoint, that gives them a level of assurance and margin probably there --

MEMBER KIRCHNER: Margin of uncertainty.

MEMBER CORRADINI: --that we're good enough. I'm not saying that that's the way the advanced designs will be, but we will get to areas where the design is uncertain enough that somebody's going to have to make a decision. It may not be us, it may be the Commission, but there would be a decision and that decision will be subjective.

It's the old adage of the umpire says it ain't a ball and strike until I call it a ball and strike.

MR. AFZALI: I agree. I think if you go to the next slide. If you are interested in what the project looks like and all that, I'll be happy to describe. But it seems you are more interested in the technical stuff. This one just gives you, you know, our deliverables, which are licensing basis events selection, SSC classification and defense-in-depth consideration and the PRA technical adequacy for making those decisions.

Those are products of our project, which I will have to come back and when we have the actual solution paths, answer some of the questions you have in the context of real examples

and a process which is well developed and argued rather than now. But can you go the next slide please? Go ahead.

MEMBER KIRCHNER: So you raise a point here. You know for the PRAs for the existing fleet, that's based on a good experiential base, good reliability databases for the equipment and so on. We aren't going to see any of that for a really advanced advance design. We'll see some of it for the two classes I already mentioned.

So the PRA is going to have inherently some -- I mean I would approach looking at it as if it had a much larger uncertainty band than we see with the current fleet and their PRAs. Wouldn't you admit that going on?

MR. AFZALI: 100 percent.

MEMBER KIRCHNER: Yeah now. Now economics come into play here. You would like, if I'm an advanced reactor designer or developer, as I was corrected earlier, then I would like to eliminate as many pieces of equipment from the SSC classification as possible, because I have a passively safe great design.

But we're not going to have that degree of confidence in our PRA that early in the

processing, yet you want to -- you want from the regulator a decision on the SSC classification, because their cost implications are real. I mean that's why you're going to passive designs, you know. You're making these things bigger or more surface to volume ratio, etcetera, to get these passive characteristics.

But you pay for that. So you want to vis-a-vis a large 1,000 megawatt plant, you always as a designer are going to have to be making it straight. So how do we -- how do you propose to have some of this "subjectivity" early on in the process as these designs come forward, because things like the SSC classification is a critical matter early on.

If you change your mind later or just like changing the seismic design criteria later, another organization does that regularly with DOE facilities, it has staggering implications in terms of cost. So would you elaborate here how you're going to do the PRA technical adequacy and use it in a way that can take out some of this subjectivity?

MR. AFZALI: So we spent a whole white paper just doing that. So we do realize that's a

challenge that we have to give it. So there is a point, and you have to realize these are risk-informed.

MEMBER KIRCHNER: Right.

MR. AFZALI: What risk-informed is use PRA insights plus engineering judgment. So there is not purely just numbers. It has a risk insight plus information from engineering judgment. Can we go to the next slide? That I think is going to -- this is what is in the current chapter, SRP 15.

What it says is you have to design for events based on their frequency and the consequences. That's what you have to do. You have to decide on the rules and you have to design on design basis and you have to do beyond the design basis. That's what you have to do.

So there's only way -- if you have to do that, there's only two ways to do it. Either negotiate it, either negotiate -- every answer that you talk about exists for a negotiated approach. Or systematic, where in a systematic way you at least have a tool to give it uncertainty in prescriptive approach, where you just make determination. You don't have any tools to deal with uncertainty other than solid conservatism.

I think fundamentally we continuously talk about risk-informed performance-based as if the uncertainties they only belong to that class of -- or that approach.

The uncertainties have nothing to do with the tool you use. Uncertainties that deal with maturity of the design, maturity of the data. The fact that to have to make a determination as is stated in GDC, as is stated in Chapter 15, is a fact.

So the only question is how best do you do that? Do you do it in a systematic way, or do you negotiate your way? You're dealing with the uncertainties in an analytical way, or do you do them abstract, a talk with vacuum conversations. That's the only difference. Now we are proposing a negotiated, comprehensive, systematic, holistic approach is a better approach, achieving the same object.

The objective is not going to change. The objective is if the risk event is defined as a part of the events frequency of occurrence and the consequences. That's our objective. Now I have not come across -- I'm not married to risk-informed or performance-based. If anybody else can come up

with any other way to better do that, then we'll do it that way. I think 30-40 years of experience working on risk-informed approaches shows the best way is through systematically as opposed to ad hoc negotiation, negotiated.

Again, I understand the people that believe this has many challenges in it, and I think that's when you bring the white paper. That's where you're going to go into detailed discussion whether what they're proposing actually has merit and should be followed.

MEMBER RAY: Okay. Let me ask --

CHAIRMAN BLEY: I'm going to -- I'll let you go in a second. I'm going -- I want to hurry this up, because our job is to look at what the staff's proposed and comment on it. So but we're interested in what others have to say about what they've done, but I think we've gone far enough here --

MEMBER RAY: I'll be very brief, because I mean you told me that I was getting off track earlier, and I don't want to do that again. The first sentence "If a risk of an event is defined as a product's event frequency of occurrence and its consequences."

That says to me that the design basis seismic event in a given plant is a function not just of the site itself but of the consequences of exceeding that event, right, okay. Dana, that's what I was trying to figure out. And so I could have a standard PWR at a site that I had a .3g design basis earthquake. But if I have a very safe passive plant, the design basis of the same site would be less.

MEMBER KIRCHNER: I would take it.

MR. AFZALI: Yes. Just I said yes, but I'm not sure I meant to say yes.

(Simultaneous speaking.)

MR. AFZALI: The risk event as described there is a frequency of occurrence and consequence, not consequence of exceeding that event. That's the risk. That's the definition of risk. I'm not defining it.

MEMBER RAY: Okay, and it con -- well all right. The consequences of a design basis earthquake should be that everything works as designed and you don't have any -- you don't have any consequences. But I can --

MR. AFZALI: So how do you make that decision?

MEMBER RAY: What?

MR. AFZALI: How do you make that decision?

MEMBER RAY: Well I don't know. That's what I'm trying to figure out. But my boss says I'm out of time, so I'll let it go.

CHAIRMAN BLEY: I was just testing. We've probably got one more.

MR. AFZALI: Okay, one more and I love this. I wish we could do a whole day of this. Next page, please. So I just want to emphasize that I think IAPs provide an excellent starting point for what you want to do. It shows how complicated or challenged our challenges are, and why is it important for us to solve those challenges as soon as possible.

If you don't solve those challenges, nobody would invest the money that we need to invest in modernizing the regulatory framework. So timeliness is crucial in that. We believe that our technology-inclusive policy issues like license-based event selection should be resolved as soon as possible, hopefully in 2017, and we welcome and highly appreciate that this is going to be career-ending thing for Bill and Amy.

But we highly appreciate Bill and Amy's leadership in working with us and getting us to where we are right now.

CHAIRMAN BLEY: They may have been through more controversial things. Thank you. I'm going to go to Peter, Peter Hastings.

(Pause.)

MR. HASTINGS: Good afternoon. I'm Peter Hastings, and I'll try to make this as brief as possible in the interest of time. I'm here today representing Ashley Finan, who's the Policy Director for the Nuclear Innovation Alliance. I'll be making some remarks on the IAPs and some additional remarks around the topic of staged licensing, including SDA and CDA.

Ashley sends her regrets for being unable to attend in person, but she had previous speaking engagements on the Hill today. By way of anybody who's unfamiliar with the Nuclear Innovation Alliance or NIA, it's a non-profit organization dedicated to leading advanced nuclear energy innovation. NIA assembles companies, investors, experts and stakeholders to advance nuclear energy innovation and enable innovative reactor commercialization through favorable energy

policy and funding.

They research, develop and advocate policies that enable the efficient licensing and timely early staged demonstration of advanced reactor technologies. Over the past three years, NIA has been developing strategies to facilitate efficient, cost effective and predictable licensing of advanced nuclear plants.

These strategies are based on consultations with innovators, safety experts, former NRC staff and Commissioners, members of the financial community and other nuclear industry stakeholders. The most prominent result of NIA's work to date was a report published a little less than a year ago called "Enabling Nuclear Innovation: Strategies for Advanced Reactor Licensing."

This report's available on the NIA website. It included several regulatory policy and industry recommendations including recognition of the value of stage licensing, which I'll discuss in more detail shortly; creation of a process for assessing licensing feasibility during pre-application interactions -- we talked about that a little bit toady already with the conceptual design

assessment; the use of risk-informed technology inclusive regulatory framework for new reactors, which Amir just spoke about; funding to enable the staff to prepare for advanced reactor licensing; and development and use of code standards and conventions.

NIA has engaged in review and discussions regarding the staff's vision and strategy document and the accompanying implementation action plans. NIA is pleased with the alignment of the NRC staff's efforts with NIA's recommendations, and pleased with the interest that staff has shown in working with the industry to address these challenges.

I want to echo whoever it was that indicated earlier that the staff has really done a lot more work than I think maybe they had to in terms of the amount of funding they were allocated. So we appreciate that.

NIA has shared with the staff that the vision and strategy is an excellent foundation for the non-light water reactor mission readiness efforts, and has expressed support for the overall direction of the document, as well as the majority of the details contained therein.

The NIA comments in October also discussed development of the staged review process, which again I'll discuss shortly. Specific to the near-term IAPs, as with the overall vision and strategy, NIA believes there is generally good agreement between the recommendations that NIA made previously on the staff's approach, and strongly supports each of those six strategies.

NIA's comments to the staff in October recommended priority development of Strategy 3 for review guidance within the next two years. Ambitious, but we think it's important. In the more detailed Volume 2 of the near-term IAPs, Strategy 3 was further developed into a comprehensive series of supporting tasks.

We continue to encourage development of this guidance, including collaboration with the industry efforts and establishment of this conformed technology-neutral framework, and to look for every opportunity to accelerate these efforts, for all the reasons that we just spent time talking about.

MEMBER CORRADINI: So maybe it goes without saying. So am I -- is my impression of your second major bullet that five years is too

long and Strategy 3 should lead everything else, or am I interpreting that bullet differently?

MR. HASTINGS: I'm not sure lead everything else, but we should try to make every effort to get the staff efforts and the efforts of the Southern Initiative fully aligned. I think they are --

MEMBER CORRADINI: In that time frame?

MR. HASTINGS: --in general, yeah.

MEMBER CORRADINI: Okay, and just to -- I'm not asking Amir. I'm just looking for a nod. So my sense of it is, and Dana's question to him and his acceptance of it is that if one were to come up with a process, such that licensing basis events are thought through in some generalized fashion, and staff and industry are at least in the same wave length or quasi-wave length, that would be viewed as significant progress?

MR. HASTINGS: Yes. Okay. NIA also recommended an emphasis on near term progress from Strategy 5, in terms of identifying and resolving policy issues for the same reasons that the staff observed, that is that policy issues contribute directly to regulatory certainty, effectiveness and efficiency. NIA is very pleased that all the work

under Strategy 5 has been planned for this fiscal year in Volume 2.

NIA appreciates the staff coordination with the NEI regulatory task force Mike spoke about earlier on identification of policy issues. We think we have good alignment between the list that the staff keeps and the list that the regulatory task force keeps.

Finally with respect to near-term IAPs at least, NIA provided feedback that the acquisition and development of sufficient computer codes, that is Strategy 2, should be expanded. For example, we said more effective use of modeling and simulation could accelerate fuel qualification and make it more efficient and conducive to innovation.

Such expansion obviously should make maximum use of available data from the DOE complex and from other sources. The Subcommittee and the staff spoke earlier about gap analyses in this regard, and we agree that's important. Staff expansion of Strategy 2 into again a fairly comprehensive list of tasks we think is a good effort in this regard.

MEMBER POWERS: Peter, let me ask you a question about this modeling and simulation. We

had developed a database for the response of fuel to reactivity insertions for fuel irradiated up to about arguably 13,000 megawatt days per ton. And maybe a couple up in the 30,000s.

And happily went along and a lot of burn ups crept up and we said well, we can model and simulate those. Burn ups eventually exceeded 40 and eventually hit 50. And then we did some experiments in France and found that the fuel was far more susceptible to damage during reactivity insertions at high burn ups than it was where we had done our experiments.

And it was because a new phenomenon had emerged into the fuel once we crossed about 40,000 megawatt days per ton. That wasn't embodied in the modeling and simulation. Can we assure ourselves that we're not going to be vulnerable to new phenomena?

MR. HASTINGS: So it's a good question, and gets to sort of the guts of the issue we were talking about earlier. I think NIA believes that additional reliance on modeling for things like fuel qualification could also require that we take more advantage of prototype and demonstration platforms, the same kinds of things we talked about

before, operating when it's on first of a kind designs, additional testing and so forth.

There have been a lot of advances and analytical capabilities in the last several years certainly. And I think from our perspective, we look to sort of find the balance between aggressive use of analytical tools and identification of where test data is needed to substantiate things. So I take the point.

MEMBER POWERS: And I agree 100 percent. You just have to use the modeling and simulations, but it's one of those things that you can't overuse either.

MR. HASTINGS: Understood.

MEMBER POWERS: The other challenge that I think we face in this sequence of bullets you have in under here is that when I look at the computational capability is routinely available to the staff of the NRC relative to what would be routinely available to an ordinary engineering consulting firm, not relative to a national laboratory, relative to an ordinary consultant, I find them prehistoric.

And that seems to me to pose a challenge when you think about people developing

innovative nuclear fuel concepts. They will come forward with computational power far in excess what the staff has routinely available to itself.

Is the solution to that particular problem get the NRC staff better computational power? I mean, I don't know what the answer is to that, but it is clear that there is a disconnect between computational power, routinely, absolutely routinely available at any engineering and consulting firm and what's available here.

MR. HASTINGS: Well, and I can only respond sort of off the cuff. Certainly more resources for the NRC staff, maybe more availability to that sort of computational horsepower through the labs, through something like the GAIN initiative, the way that the industry is trying to take advantage of --

MEMBER POWERS: Well, it may not be part of your presentation, but I just can't avoid taking the opportunity to pick your brain here because I know you think about a lot of things.

It is that we've had a variety of presentations, the thrust of which is DOE and the national laboratories have gotten together and done X, Y, Z. Is that not impacting the ability of the

NRC to utilize national laboratories as part of its independent confirmation analyses? Or jeopardize maybe is the better word.

MR. HASTINGS: Well, I think that's the point that I made earlier. It's something to keep an eye on. I can't answer the question easily. I do know I have worked for companies where we had internal firewalls, you know, even within the same group to avoid conflicts of interest.

That doesn't seem like an insoluble problem to me, but it's certainly something to watch out for.

MEMBER POWERS: Thank you.

MEMBER REMPE: On your other strategy discussions you talk about a timeframe. And in light of the fact that Strategy 2 may require use of a demonstration or prototype, that seems to be a bit longer.

Would you agree with what some of the other individuals said, that maybe some of the activities proposed for Strategy 2 should be delayed because it is a very labor and cost intensive strategy to implement?

MR. HASTINGS: I don't know. That's a cheap answer, but I think it depends on whether the

development is something that relies testing on the back end as input.

MEMBER REMPE: But you've got to have a vendor who makes the fuel. And many of these developers don't have that. And so I would tend to agree what I've heard other individuals up here say about maybe some of these activities could be delayed.

MR. HASTINGS: Yes, I take the point. I don't have enough, good enough grasp on the details of how those activities fit together. But it seems like that's a pretty straight forward project management exercise, right? You model --

MEMBER REMPE: You've got to have data though to --

MR. HASTINGS: -- your dependencies, your successors and predecessors and see how it falls.

MEMBER MARCH-LEUBA: On that topic, but completely different Strategy 2, this morning we had to go back and forth with the staff on whose responsibility it is to develop all this data and validate all these fuels and do all this modeling.

If I read your slide, you believe that this is the staff responsibility to do it.

MR. HASTINGS: No, no. Well, yes and no. the applicant is responsible for providing the analytical basis for his license application. The staff is responsible for having the tools to evaluate that.

Where that, where the staff needs to develop an independent model, that's the staff's responsibility. Where there's an opportunity for the staff to use the applicant's model, then they may collaborate or it may be something that they pull off the shelf.

MEMBER MARCH-LEUBA: So you think the industry should have a good, a complete development of methods and experiments, and have some independent peer review before it's submitted to the staff?

MR. HASTINGS: Absolutely.

MEMBER MARCH-LEUBA: And it is up to the staff whether if you present such a good job, maybe they don't need a confirmatory.

MR. HASTINGS: The obligation of the staff to perform calculations and have them reviewed internally before they --

MEMBER MARCH-LEUBA: The staff is to review your calculations.

MR. HASTINGS: Right.

MEMBER MARCH-LEUBA: And if they find no uncertainty with them, fine.

MR. HASTINGS: Right. But they have no obligation for development of the licensing basis. That's the applicant's responsibility.

MEMBER CORRADINI: I think the reason he asked that and the way you answered makes me feel very good. But are some of the firms that are considering these innovative designs aware of the level of effort that that requires, because I sense that they may not be.

MR. HASTINGS: I can't speak for many of them individually. The ones I've spoken to recognize it.

MEMBER CORRADINI: Okay.

MR. HASTINGS: Whether they have fully internalized what that means in terms of the level of effort, that's another matter. But they understand the obligation.

MEMBER CORRADINI: Okay. And is that, and maybe I misinterpreted. I guess is that what they may require enhanced use of demonstration and prototype provisions mean? I don't know what that bullet means. I interpreted it one way, but maybe

I misunderstood.

PARTICIPANT: Well, I think --

MR. HASTINGS: I'll give you a licensing answer. It depends. If a model that you're developing, if the model, excuse me, that you're using for your application doesn't have sufficient test data to back it up in your review as an applicant, you may propose additional prototype controls on that design for first implementation.

You may, on the other hand as an applicant, feel that it is sufficient and the staff may disagree, and there may be a negotiation of prototype controls that get put on as a result of NRC review. So it can happen both ways.

MEMBER CORRADINI: Okay.

MEMBER POWERS: What we see in this discussion, or in the staff's portion of the discussion for instance, we saw closer coupling between thermohydraulics and neutronics in some of these designs.

One has to understand that that interface between two codes is in fact a model itself, and it is the most difficult model to independently verify without doing your

demonstration and prototype sort of thing.

And that's pervasive through all the codes. It is the interfaces between two models is a model itself, and one that's very difficult to validate.

MR. HASTINGS: Understood. All right, so turning to a related topic, NIA suggested in its paper and various interactions with the staff that stage licensing should be further developed. And this has been the subject of quite a bit of confusion, mainly over terminology.

While it's important to emphasize that stage licensing provisions are optional, excuse me, that is an applicant needn't take advantage of them. We nonetheless believe these tools can be valuable for developers interested in using them, and we're working with the industry to try to help develop some guidance in this regard.

Our emphasis on this approach is threefold. First, a conceptual design assessment which we've talked about at length here, should be developed to enable more structure and certainty from pre-application interactions.

NRC staff have discussed the development of the CDA process in this fiscal year

and the near term IAPs which NIA believes is appropriate and looks forward to progress in this area.

Standard design approval has also been discussed as a means to provide a detailed review of "major portions," that's language from the regulation, of the design, without necessarily having to complete the entire design.

And there's been some discussion of that in the difficulty of understanding how to draw the box and how to model the boundary conditions and the interfaces around that. And we recognize that's the most complicated part of defining major portion when developing a standard design approval application.

NIA happens to be in the process of leading the industry effort to try to right that now.

MEMBER CORRADINI: So can I stop you there because this one confuses me. And is there an example, by the way, you made reference to a paper. Did we miss a paper that --

MR. HASTINGS: It's in review as we speak.

MEMBER CORRADINI: So we don't have it?

MR. HASTINGS: You don't have it yet.

MEMBER CORRADINI: Okay. All right, that explains one of them. So is there an example of a major portion that doesn't have enough system interactions that it's an island unto itself?

MR. HASTINGS: So to my knowledge, and I would invite the staff to correct me if I'm wrong, but I don't believe the SDA provision of the regulation has been exercised to date.

MEMBER CORRADINI: Okay, I'm unaware of it. That's why when I saw the, your slides I scratched my head here.

MR. HASTINGS: In a previous life, we kicked around the notion of an SDA that, speaking very simplistically, involved getting approval for the nuclear island with the turbine building that most of the balance of plant outside the envelope of the SDA.

And that would be a substantial set of interface conditions, but it would also set you up for the evaluation of the nuclear island in the context of having a design that could be plug and play to process heat or desalination or power or whatever.

Setting the boundary conditions would

be important, but getting design approval for the nuclear island without the remarkable expense of all of the civil design of your turbine building, for example, could be of benefit to the developing.

Now very clearly, I've heard this question before so I'll ask it of myself. Does that mean that that in any way is going to make the deployment of that plant faster, and the answer is no because you're still going to have to get the approval in some licensing context of the turbine island.

So it's recognized that by introducing the SDA, you're introducing another step, and a more complicated licensing process and some downstream licensing risk. The reasons to do that could be many fold. It could be --

MEMBER CORRADINI: Business reasons.

MR. HASTINGS: -- that you only have enough money to do this much design until you get some commercial interest. It could be that you're developing a design for deployment with sufficient optionality as to what the back end looks like, that you don't want to invest in that latter half of that design but you do want to switch then to NRC approval.

MEMBER CORRADINI: But an example that you bring up which is separating the nuclear island from the power conversion system is a logical thinking. I was trying to, I thought somehow this was a smaller subdivision and I was struggling as to what that would be.

MR. HASTINGS: Well, and that's what we're exploring right now in our paper. So an SDA is presumably bigger than a topical report, right, but smaller than a design cert. There's a lot of space in between those two, obviously.

MEMBER CORRADINI: Right.

MR. HASTINGS: And one of the challenges is if one believes that a topic could be developed for SDA, one should look at whether it's sufficiently small that you're better off just writing a topical report.

Just writing a topical report, it's not easy obviously. But if it gets better into the topical report model, why introduce the additional sort of programmatic risk of an SDA process that hasn't been really totally --

(Simultaneous speaking.)

MEMBER CORRADINI: So that's still being kicked around by --

MR. HASTINGS: Correct.

MEMBER CORRADINI: Okay, because the reason in guess I'm bringing this up is it kind of goes back to Jim's cartoon about how this all kind of fits together and there's enough connection boxes. But if I look at the nuclear island, then I can see where there might be an argument that if I had multiple applications that may or may not have a power conversion system, they may -- and I see it.

But even then, as you said, it could add time. In a different meeting, Ms. Finan has presented something like that. But the boxology that was showing in that cartoon was smaller boxes, and that concerned me.

MR. HASTINGS: And the smaller the box, the more complicated the boundary condition.

MEMBER CORRADINI: That's why I point to Jim's cartoon.

MR. HASTINGS: Yes, okay. I agree. And we're wrestling with that in real time.

MEMBER CORRADINI: Okay, thank you.

MEMBER KIRCHNER: Just one other point. Unless it's immaculate conception, it almost presumes that you have a perfect design out of the

box. I'll wager down the road that that will not be the case for these advanced concepts. So I just point that out.

MR. HASTINGS: Well, that's one of the things that we're wrestling with too is --

MEMBER KIRCHNER: The danger that you pointed out of adding complexity and another step that may come with the standard design approval is something that one should weigh very carefully.

MR. HASTINGS: That's one of those programmatic risks that we need to consider, I agree.

MEMBER CORRADINI: Sorry to delay this. I'm sure the Chairman will shut us up eventually. So when NIA does this, do you probe the industry, the task -- I'm sorry, if you have a working group or a task force, I can't tell, Amir's group and try to get their input into this?

MR. HASTINGS: Absolutely.

MEMBER CORRADINI: Okay, because my concern would be that as long as this is done within immediate discussion with a lot of different industries, then it might get to some better place. But some of this I'm struggling to see how this could be regularized.

It seems to me for a gas reactor or a sodium reactor, they're mature enough that you might not want to take this approach. But for other and more unusual designs, this might be a way to consider it.

MR. HASTINGS: Yes, and there are many factors to consider in deciding whether this is one of the options you should exercise. So that's --

MEMBER CORRADINI: Did you, you used the term, were you here for our little discussions about stage licensing earlier? Okay, so you're on the taking the alternative of the two alternatives that this is a, I was going for the words there on your slide.

Anyway, it's a, you define a major portion and that becomes a basis for a stage in the process as opposed to a process staging in which you're going from less certainty to more certainty, is that correct?

MR. HASTINGS: The answer's both. So I take stage licensing to mean carving up the continuum of NRC interactions from pre-application introduction all the way to start up into digestible chunks. And with as much predictability and certainty as you can get for each of those.

And it's a good segue to my final point which is the notion of using a licensing program plan to map all this out. And we've talked a little bit about the fact that the industry is working on what a licensing program plan should look like.

The staff has used licensing program plans in the past, somewhat inconsistently. But they feel very strongly and we agree that it's a, it can be a really good tool to plot out a couple of things.

One, what those pre-application interactions are going to look like. Given the lack of finality to it, but the possible benefit in terms of investor confidence, is a conceptual design assessment something that's worthwhile. Or if the money worth the incremental delay in that part of your schedule, yes or no.

Is an SDA the right choice for your design or do you want to go to a CDA. Or maybe you want to go straight to construction permit and operating license under Part 50 or a COLA without a design cert. Or maybe you want to go to a cert.

A licensing program plan should give the applicant and the staff a platform to have a

common understanding of what that's going to look like and make your schedule that much more predictable.

So we're a big fan of the notion of licensing program plan, and we're working very closely with the industry to try to get our thoughts of what the format and content of that plan could look like.

Again, they could, not should because licensing program plans, CDAs, SDAs, none of them are required. They're all optional. But we're trying to help create the optionality and the toolkit if you will so applicants particularly, developers without a lot of experience in licensing can have a bit of a guide in how to pick the rest of the right options for them moving forward.

MEMBER CORRADINI: So just to follow on that point since there was a parallel meeting this morning on this. Did your colleague emphasize the need for that to the congressional people so that they understood that the onus does fall upon the developer to have such a thing as a licensing program plan, because to me what worries me is the congressional types may turn to the NRC and say thou shalt whereas I think the thou shalt kind of

slides on both sides.

And the need for a licensing program plan as you've described it to me is very important.

MR. HASTINGS: It's a good question. I frankly just don't remember if Nina talked about the licensing program plan or not. Does anybody happen to know? I just don't remember.

MEMBER CORRADINI: Okay. All right, thank you.

MR. HASTINGS: So in conclusion, we appreciate and support the efforts of the staff. We look forward to continue development of both the strategy documents and the various aspects of stage licensing. We're currently reviewing the mid and the long term IEPs that were recently released, and thank you for your time.

CHAIRMAN BLEY: Thank you very much. Anything else from the members?

MEMBER CORRADINI: You are correct. On Page 23 of Senate Bill 512, they discuss using a licensing project plan as one of the needed tools. So thank you.

CHAIRMAN BLEY: That's good. What we're going to do is we're going to get public

comments. Then we're going to go around the table for all of the members. Then we're going to go off the record, and at that point I would like the staff to come back to talk with us about the full committee meeting. Yes, mike?

MR. SNODDERLY: Yes. I just wanted to add perhaps while you have some of the panel members that you have scheduled for tomorrow, did you want to have any kind of discussion what your expectations are for them tomorrow because tomorrow from 3:45 to 4:15 we have an industry perspective panel with Amir, Peter Hastings, and Mike Schultz.

CHAIRMAN BLEY: Thank you, I forgot. Yes. So maybe all of you can stay with the staff as we talk about tomorrow. We'll get to the phone line in a moment. At this time, I'll ask is there anyone in the room who would like to make a comment? If so, please come to the microphone.

Is there anyone on the phone line who would like to make a comment? If so, identify yourself and make your comment.

PARTICIPANT: Bridge open.

CHAIRMAN BLEY: I think you can close the bridge again. At this time, I'm going to start with Professor Corradini. I'm going to just go a

little slow. If we write, you know, I have to write a letter, I've already agreed to that, I won't have a transcript for writing the letter.

So all of you members of the committee who have things they're going to say as we go around here, or said earlier, if you drop me a note tonight with a paragraph about what you think ought to be in the letter, I would appreciate it. Mike?

MEMBER CORRADINI: Thank you. I guess I would thank the staff and members of the industry and various groups that have come up because I think it was very helpful. I guess my only suggestion, I've sent Dennis some notes ahead of time.

CHAIRMAN BLEY: And thank you for that.

MEMBER CORRADINI: Yes, right. I guess my only thought would be, and I'm not sure how to frame it, but I still think the strategy three and strategy five have to be done early in the five years, otherwise the other things don't follow logically.

And so I'm pretty sure staff said is they're still knitting together how the six strategies fit, if there would be a recommendation that would come from us, if the other members feel

appropriate, I do think the need to flesh out how Strategy 3 knits with 5 which leads to the other things is a very important part of our suggestion at this point in time.

Otherwise, some things will get ahead of other things. And I do think, I'm not sure which of the members of the industry said this, maybe it was Amir, maybe it was Peter, I can't remember, that I think those two ought to come first in terms of the overall planning.

The second part of this is I guess it doesn't fall upon the staff unless the staff in 3 and 5 will present it, that a project plan from the applicant, whoever that applicant might be is important. And it's kind of like what are they expecting to do and how do they expect to do it so that staff can react to it.

I think that's also very important. That's why I think I asked the question of Peter at the end. Other than that, I just wanted to thank, I think staff has done a pretty comprehensive job of trying to think through all the things they need.

CHAIRMAN BLEY: Thank you. Dana?

MEMBER POWERS: Well, to be sure, the

staff has embarked upon developing a strategy for safety oriented valuation of reactor designs without the benefit of a rich background of operational experience.

And of course this is a challenge in many ways. The urgency the industry has expressed in developing this is probably one that deserves more thought on how to expedite that.

I can offer a couple of observations from the presentations here. It perplexes me that we are retaining the baggage of the design basis accident concept. This seems to be a concept that accrues best to the designers and is not essential for the regulatory process.

I am gratified to see how much the staff has thought about the need for adequate experimental data to validate analyses. And I thought their thinking on this was fairly sophisticated and adequate.

I am puzzled by the communication strategy does not include a reach out to the technical learned society is beyond the relatively closed community that has participated in various workshops and meeting.

PARTICIPANT: I think that what I have

in my preliminary thoughts I will try to drop you a note for --

CHAIRMAN BLEY: I will appreciate it very much. Thank you. Dick?

MEMBER SKILLMAN: I thank the staff and the other organizations for a thorough presentation. I remain convinced that these criterion 26, reactivity needs to be in full alignment, particularly for those cores where the coolant and the fuel have a radically different neutron response.

What was expunged from the currently recommended criterion 26 is no working on controller react to any. And I believe that that is a feature that needs to be in the advanced record as here.

CHAIRMAN BLEY: Thank you. Harold?

MEMBER RAY: Well, we had a very, I thought, effective and good discussion with staff this morning on the proposition that I don't, I'm not confident it's reflected yet in what the other side will bring to the table in this plan because the plan deals with sequence and stages at which the review is conducted as well as with what the result finally is, however that's defined.

But at some point there is a obligation, and under the regulations it was placed there in the '70s, 1970s after many other efforts had fallen short which makes the applicant, or the licensee as the case may be, responsible for assuring the quality of the information presented.

That's contrasted to the model in which the applicant presents information and the regulator, whoever that may be, reviews it and either accepts it or either accepts it or doesn't in so far as if the review by the regulator in whichever areas they choose to review discovers a failure to comply with the requirements for assuring quality, then the applicant or licensee typically then has to go back to the end of the line and start over again and show that that was the only place that this shortcoming occurred, or that they've located and dealt with other ones that were affected by it.

All of that means to me that we should high confidence in the information, should be able to have very high confidence in the information presented not during the early stages let's say of discussion about what, how to think about the requirements, but as we're going through this

staged process and get to points at which we have accepted a portion or a, however whether it's vertically or horizontally staged, of what's been submitted.

That should, we should have high confidence. We found that we had more confidence than we should have had at times in the past, and we should learn from that experience. And like I said, it was at one point in the Agency's history it was decided that it had to be captured in Appendix B.

The problem is, with Appendix B is that it only applies to safety related instruction systems and components, and typically we're looking here at a lot of information that would be arguably, wouldn't meet that criterion.

So in any event, to try and summarize for you, Dennis, I'm just interested in our having confidence that the applicants understand their obligation to, for example, independently verify themselves, not have verified by the agency the accuracy of the information that they submit.

And if it's found to fall short of that, they then have a large burden, Dick would refer to Part 21 but however you style it, they

have a large burden to go back and say that's the only place where I've made this kind of mistake where I've found others and taken care of them as necessary.

So that's my input. Now that doesn't help you when it comes to writing a letter, but I'll try and think along with the other stuff I'm doing how you might express that --

CHAIRMAN BLEY: You have a letter of your own, I understand.

MEMBER RAY: I have one of my own. But the shorthand is simply to say if you're going to apply for something and seek approval of it, whether it's staged or all at once, I don't care how you do it, you got to comply with Appendix B. And if you don't, you got some work to do.

CHAIRMAN BLEY: Thank you. Matt?

MEMBER SUNSERI: Thanks, Dennis. I agree with my colleagues that I think that the staff and the industry have both presented very comprehensive and given a lot of thought to the process and the way to go forward here in developing appropriate action plans.

And listening to the conversations, and I'll call it unbiased way because I don't have a

horse on either side here, the staff or the industry. Just trying to make sure the right things happen here.

My sense is that, you know, there's discussion of this gap and expectations on, you know, move faster, whatever. But my sense is listening to unbiasedly, that gap is smaller and that both sides are closer together than you're giving yourself credit for and working together, I think you can close the gaps a little faster.

And obviously there's some exceptions to that, there's some areas but generally overall I think that both sides are pretty close. So having said that, Dennis, I'll just look forward to working with the committee on the letter.

CHAIRMAN BLEY: Okay, thank you. Ron?

MEMBER BALLINGER: Green light.

(Off microphone comment.)

MEMBER BALLINGER: Never mind. I agree with my colleagues, and Harold has said it much better than I could ever say it. But I think the Appendix B responsibility is really, really important. And I sort of assume that people already knew that. But anyway, that's all I have.

CHAIRMAN BLEY: Thank you. Joy?

MEMBER REMPE: I wanted to share my thanks too for the presentations, and the staff as well as industry. I agree with what I believe Mike was trying to get to about the prioritization of Strategy 3 and 5. And I believe we heard that from industry too.

I believe the staff told us that what we have reviewed isn't the latest on what's going to be done on Strategy 2, and I would support that that strategy be thought carefully through so that some tasks that could be delayed would be.

I find that a lot of things might be resolved if the industry comes in with the appropriate pedigree of models, et cetera. What I learned, I guess, too was that what I heard from industry today from many of the presenters is that the modernization activities from the staff are closely aligned to what they're thinking about in the near term.

And I had not gotten that from the popular press. And so I hope our letter conveys some of that because I think that would be a service that we could do in our letter.

And then I guess the other thing with Harold and some of my colleagues have brought up

about the QA, yes I understand you would have a graded approach. But I think helping early on in what's submitted requiring them to do as the Canadians have indicated in their view graphs that were provided to us, having their process for ensuring quality reviewed by the staff to help emphasize that point would be helpful.

And I think the folks from several industry organizations said that the people they've been working with already have a good appreciation of the quality needed. So it might not be such an onerous thing to stick on to the developers at this time.

So I would like to see something like that included in our letter. And then I guess I just want to emphasize a bit that the staff said that they're taking care of it, but I never saw lead cooled included in all of their documentation explicitly, and I think that that needs to be conveyed at some point.

It's a nit but I think that the staff is aware of this, they're fixing it. But it's not been something we saw. And that's it, thanks.

CHAIRMAN BLEY: Thank you. Mr. Brown?

MEMBER BROWN: I'll have no additional

comments other than I fundamentally align with Harold relative to the Appendix B approach. I think it's the responsibility of the applicant to demonstrate that he satisfies and takes care of the rest of the public and meets those requirements, demonstrates that he has the technical background to support his license application, or pre-application, whatever stages we want to put him in.

CHAIRMAN BLEY: Dr. Kirchner.

MEMBER KIRCHNER: Thank everyone for the presentations. I too, I guess I'm going to be repetitive at this point. The emphasis on a quality application I think is key. I think Strategy 3 and 5 ore much more important right now than 2.

For example, just not to dwell on specific points but in the NIA presentation one could misread this. I think maybe I'm misreading it, that the NRC should enhance their modeling and simulation capabilities for fuel qualification.

That's the responsibility of the applicant. The NRC may choose not to develop any codes to look at fuel qualification. They may say bring me the empirical evidence. They could anyway.

I then just, I'm still thinking over your presentation, Amir, and I'm thinking through, this is a conundrum. I'll just throw this out and then I'll stop.

The more that you use a risk informed approach, may that not require a more complete design early on than doing a deterministic go through the GDCs as modified for the advanced reactors approach? In other words, an old fashioned defense in depth, do the GDC approach versus a more modern, if that's the right word that you're using, risk informed approach?

It seems to me that I believe in using these techniques like PRA to inform the design and the analyses and such. But it's going to require a fairly mature design for the regulatory not to make a subjective decision on what is safety class and what isn't.

Do you see where I'm going with this? So with that, I stop. Thank you.

CHAIRMAN BLEY: I was taking notes. Jose, you're up.

MEMBER MARCH-LEUBA: Yes. At the moment I have a Wi-Fi connection I'll send you these, but I'll read it right now. In the near

term, the staff should develop physical insights about the new reactor process.

One way to achieve this is to collect available experimental data relevant to the likely designs and concentrate on benchmarking efforts instead of attempting to develop new codes.

Only those benchmark efforts show existing co-deficiencies to the models we have available. This process will also show the holes in the available experimental data. We should guide the staff and applicant's needs. And that's it.

CHAIRMAN BLEY: That's good, and you'll send it. I appreciate it. Pete?

MEMBER RICCARDELLA: Well, being last in the chain, I really don't have anything to add to the comments of my esteemed colleagues. But I would just like to thank all the presenters for a very informative day. Thank you.

CHAIRMAN BLEY: Just a second. Okay, again, thanks to the staff and to the folks from industry. This was very informative. Sometimes we push a little hard because we don't have much time to get through this sort of stuff, and I appreciate your tolerance and that kind of grilling.

It was a useful day for me. I would, I certainly agree for me Chapter 3 is the, or Strategy 3 is the real key for getting this thing moving. I'm still a little uncomfortable with the focus on codes in Strategy 2.

It's more than that, and it kind of feels to me from the discussions we had that the title is driving the thinking to some extent.

A couple of other things that, you know, if we're borrowing the DOE design process names, that's okay. But we ought to really define them so people understand exactly what they mean here and don't make mistakes along the way.

The licensing basis events kind of are the key for making this whole thing work, and I would go a little further than Walt. I agree with Walt, but the risk informed approach requires a complete design. It also requires understanding how you're going to operate that complete design. And further, it requires a real quality PRA, not the kind of things we've been seeing in the design cert stage.

You're going to be making decisions picking the licensing basis events. You got to have the design, you got to know how it's going to

be operated, you got to have a really good PRA if you're going to do that.

MEMBER CORRADINI: Or you have a very big uncertainty band.

CHAIRMAN BLEY: Or you have a tremendous uncertainty band that might completely upset the apple cart when you go further down the path. I just don't see how you do it without those things being complete.

When you get to that point, you got to have that. With that, we're going to go off the record and then we're going to talk a little bit about tomorrow and how we pass through that process.

(Whereupon, the meeting in the above-entitled matter was concluded at 5:56 p.m.)

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ACRS Future Plant Designs Subcommittee Meeting

Non-LWR Vision and Strategy Implementation Action Plans

March 8, 2017

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Outline

- Introduction
- Summary/Overview
  - Vision and Strategy
  - Implementation Action Plans
- Implementation Strategies
  - Strategy 2 – Computer Codes and Tools
  - Strategy 3 – Flexible Framework
    - Regulatory Review Roadmap
    - Licensing Bases
  - Strategy 5 – Policy Issues

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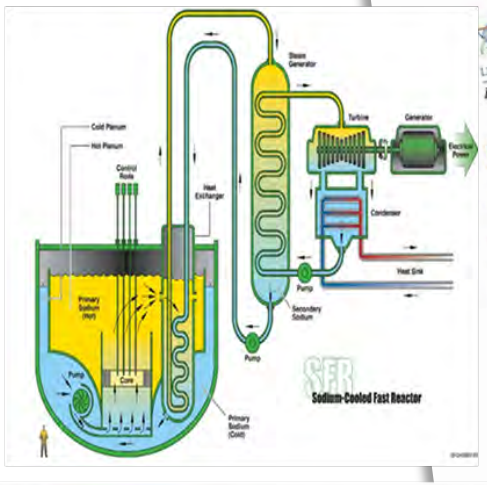
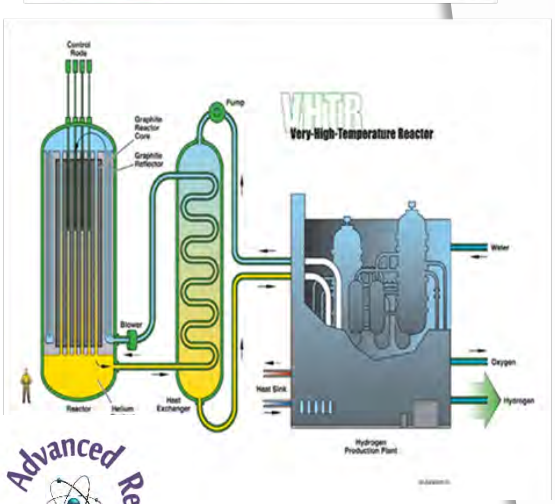
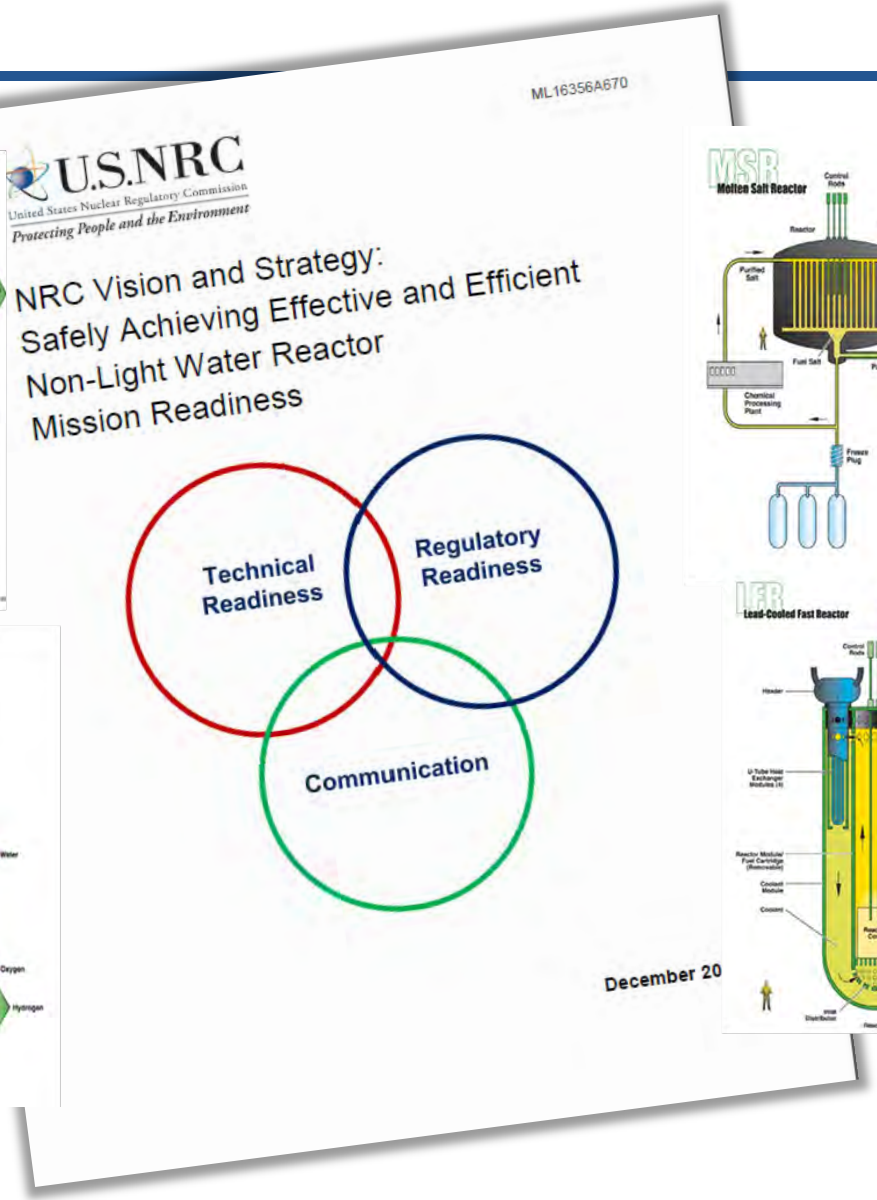
Interest in Advanced Reactors

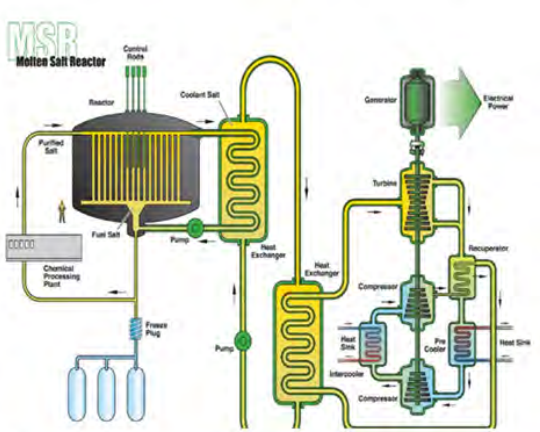
- DOE and NEI deployment goals
- Dozens of companies are working on a variety of advanced reactor designs
- Legislation has been put forward in both the House of Representatives and the Senate

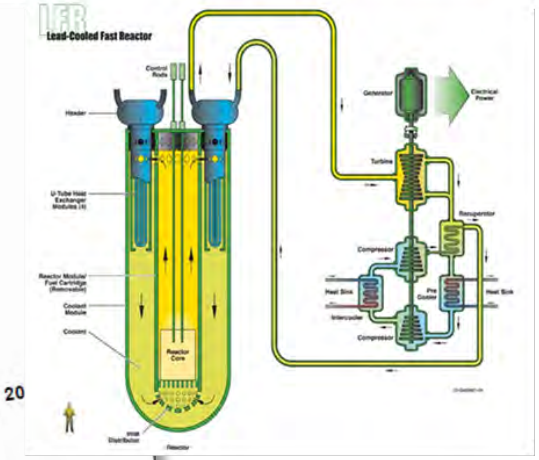
Non-LWR Vision and Strategy



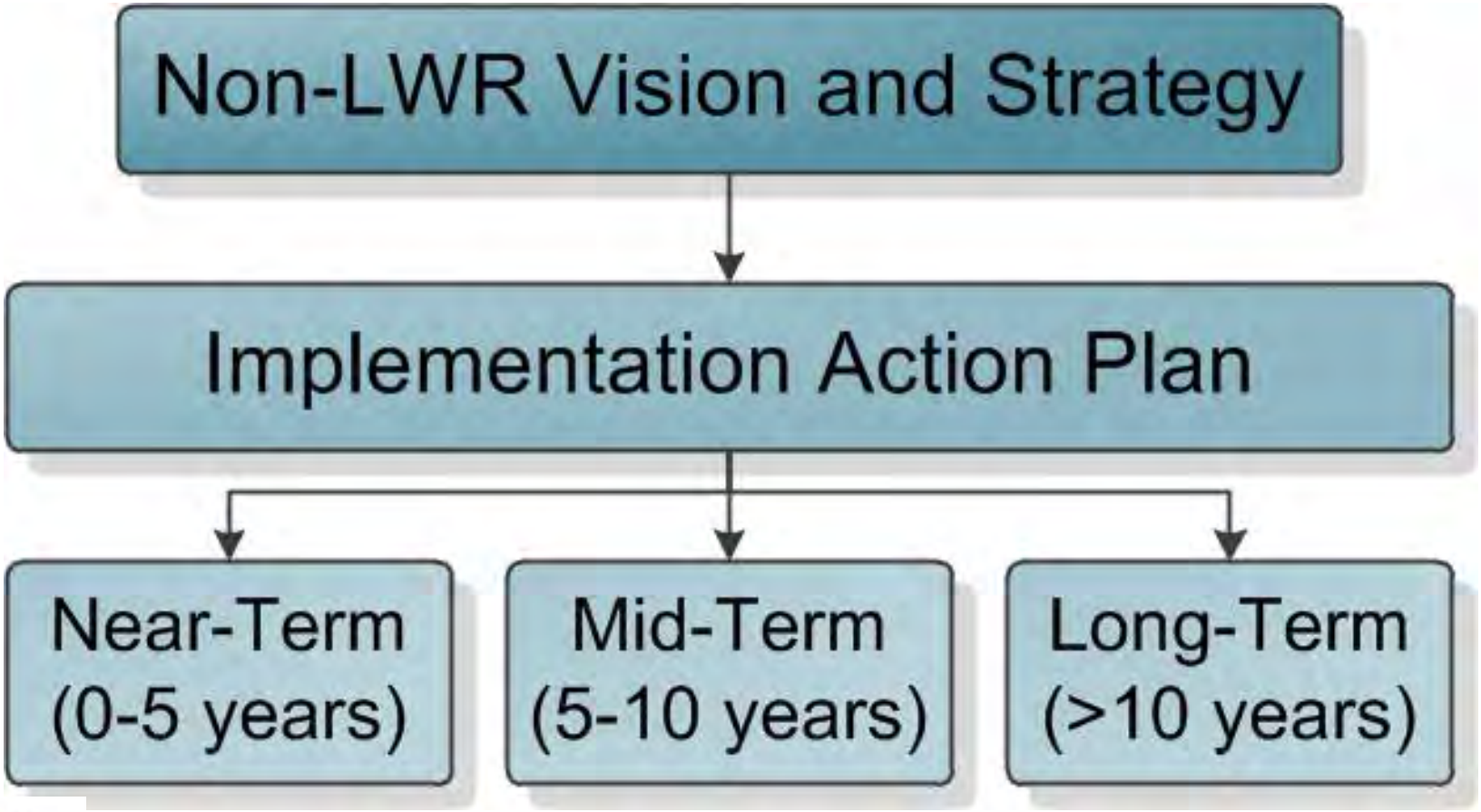








Implementation Action Plans (IAPs)

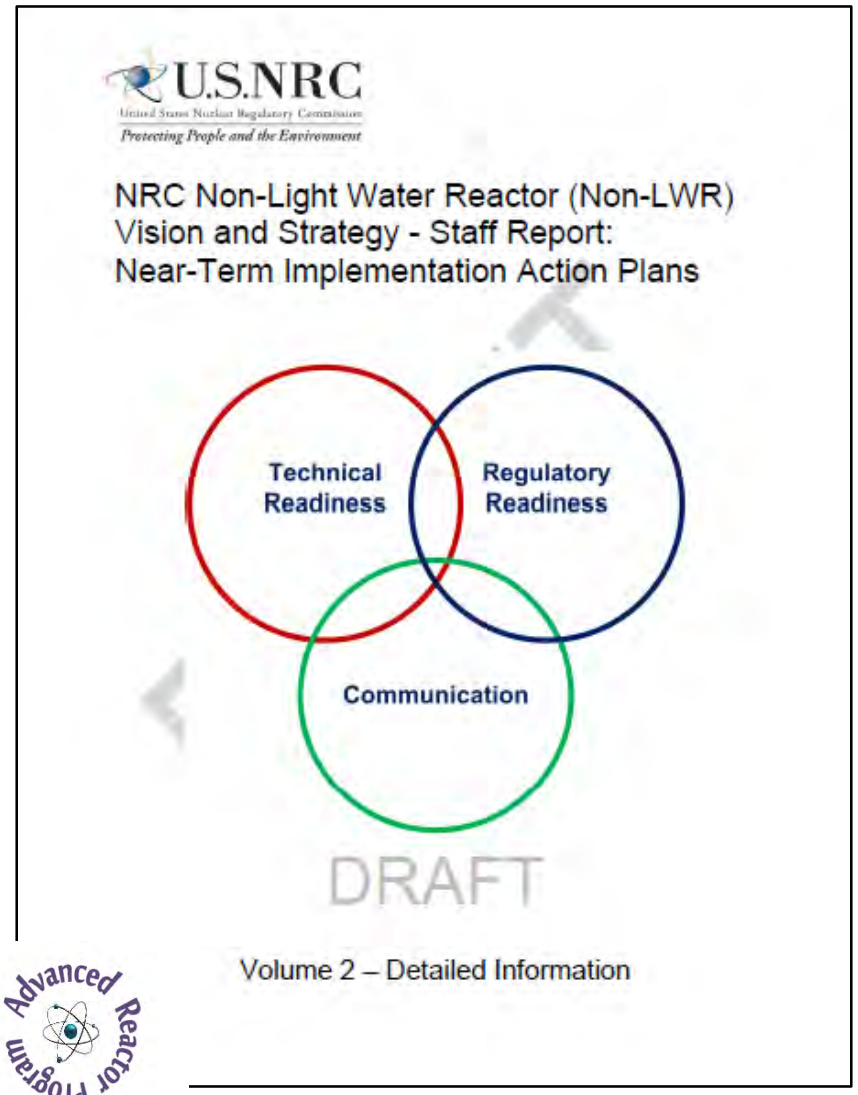


Implementation Action Plans (IAPs)

The IAPs are planning tools that describe:

- Work to be done to achieve non-LWR readiness
- Resources needed to accomplish the work
- How the work should be sequenced
- How to prepare the workforce to do the work

Near-Term Implementation Action Plans (IAPs)



- Five-year timeframe
- Draft was made available for stakeholder input in Fall 2016
- Some near-term activities already underway
- Plan to finalize the IAPs this Spring

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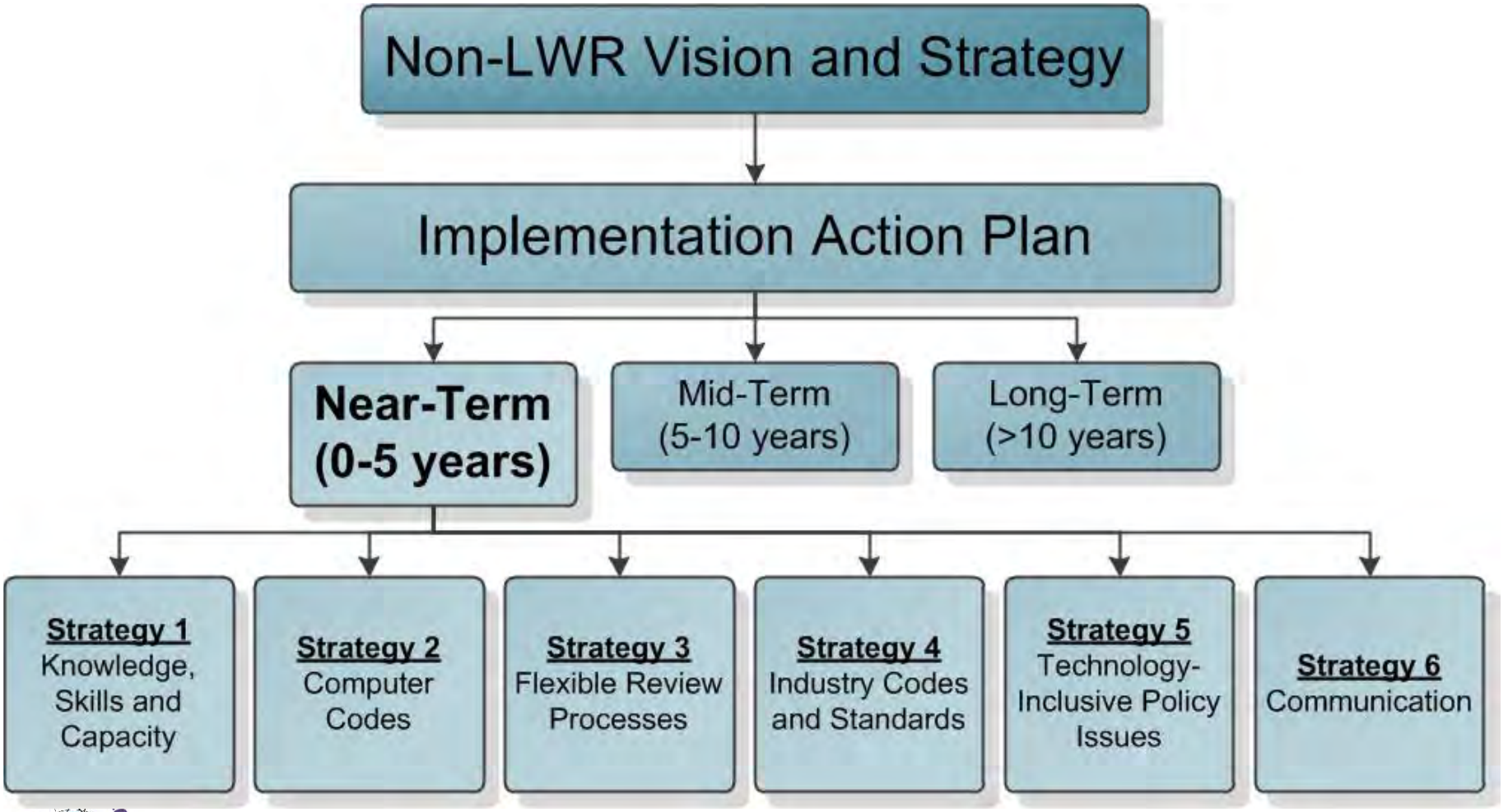
Near-Term Implementation Action Plans (IAPs)



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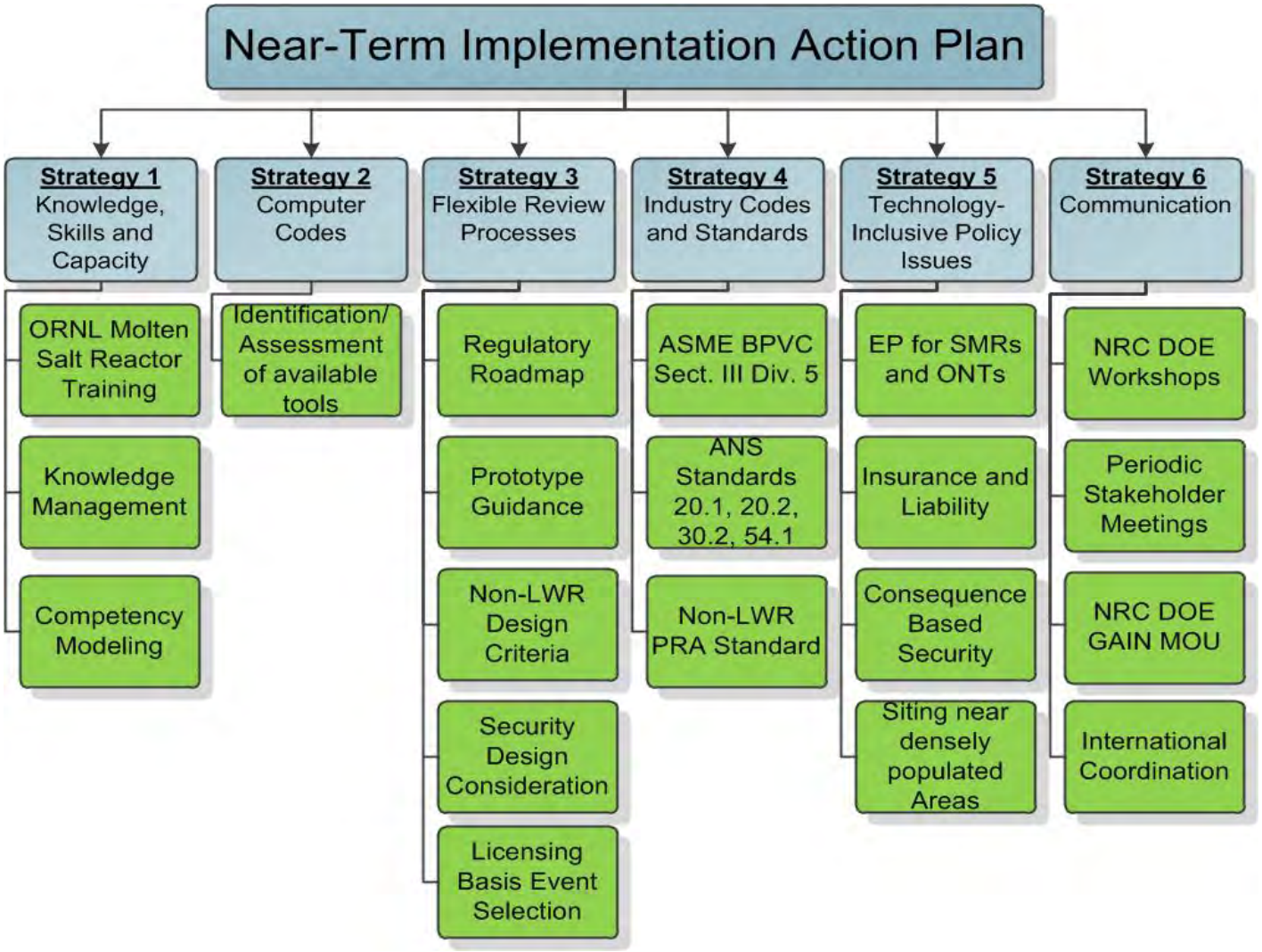
Examples of Ongoing Near-Term IAP Activities



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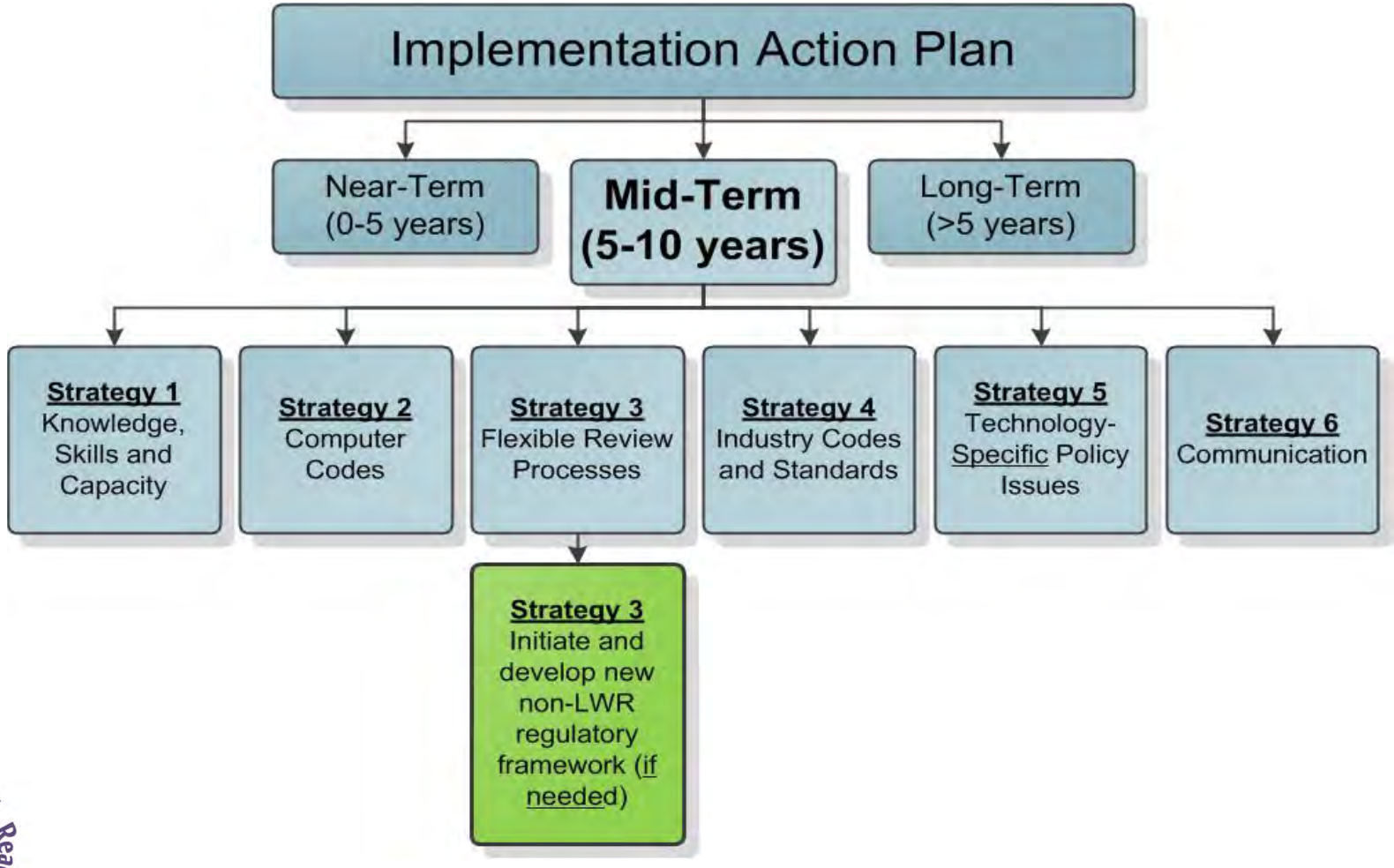
Mid-Term Implementation Action Plans (IAPs)



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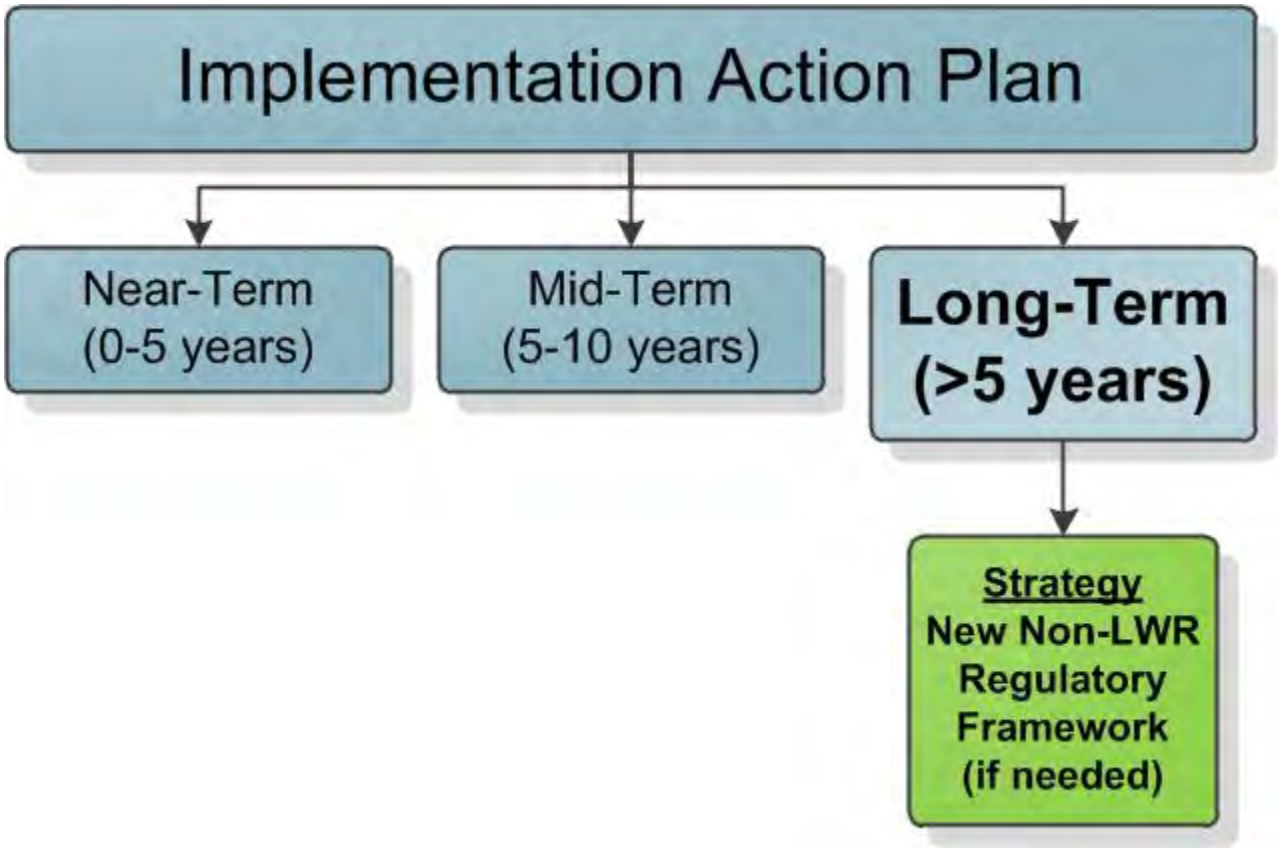
Long-Term Implementation Action Plans (IAPs)



Outreach Activities

- NRC-DOE Joint Advanced Reactor Workshops
  - First workshop was held September 1-2, 2015
  - Second workshop was held June 7-8, 2016
  - Third workshop scheduled for April 25-26, 2017
- Stakeholder meetings every six weeks
  - Next meeting March 22, 2017
- Gateway for Accelerated Innovation in Nuclear (GAIN)
  - GAIN MOU signed on November 10, 2016
- International Participation
  - NRC chairs the Group on the Safety of Advanced Reactors (GSAR)

Pre-Application Activities

- Oklo, Inc.
  - Pre-application meetings held on November 17, 2016 and December 14, 2016
- Terrestrial Energy
  - Plans to seek pre-application interactions prior to the 2019 timeframe for its Integral Molten Salt Reactor
- Core Review Team Approach
  - Supports efficient and effective pre-application interactions
- Additional pre-application reviews anticipated in the near-term

Strategy 2: Computer Codes & Tools

Strategy 2 is designed to "Acquire/develop sufficient computer codes and tools to perform non-LWR regulatory reviews"

- Enables the staff to perform independent confirmatory analysis of safety significant design basis and beyond design basis accidents.
- Identifies experimental information necessary for regulatory decisions.
- Can provide the basis for rulemaking and regulatory guidance.

Functional Areas & Prioritization

- **Reactor Kinetics and Criticality**
- **Fuel Performance**
- **Thermal-Fluid Phenomena**
- **Severe Accident Phenomena**
- **Probabilistic Risk Assessment**
- **Materials and Component Integrity**

Primary Focus FY17-FY18

Secondary Focus FY-17-FY18

- **Offsite Consequence Analysis**
- **Instrumentation & Controls**
- **Security**
- **Human Factors**

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Technical Challenges

- **Staff Familiarity of New Designs**
  - Understanding physical processes for numerous designs; GCR, SFR, MSR.
- **Fuel Performance**
  - UO_2 fuel well established, but gaps exist for non-LWR fuels.
- **Neutronics**
  - Fast spectrum systems require analysis of more energy groups.
  - Benchmarks for > 5% enrichment.
- **Severe Accident Phenomena**
  - Identification of any new phenomena, Fission Product transport.
- **Materials**
  - High temperature material behavior.

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Technical "Benefits"

- **Previous Efforts for NGNP**
  - Path forward relatively well known, with technical issues identified.
  - Analysis codes selected and development started for GCR.
- **Single Phase Coolants**
  - Lack the complication of two-phase flow, thermal non-equilibrium.
  - Amenable to analysis with CFD.
- **Significant Safety Margin**
  - May allow for large modeling and simulation uncertainties.
- **Fission Product Capture**
  - Sodium and molten salt coolants may be very effective at capturing FP.

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Initial Efforts

- **Phenomena, Scenario, and Issue Identification**
  - To be generic when possible, but more specific as design information is made available. Goal is to facilitate planning of future development.
- **Selection of Computer Codes for Confirmatory Analysis**
  - Much tighter coupling between fuel performance, neutronics, thermal-hydraulics than in most conventional LWR analysis.
  - May involve NRC developed codes, or adoption of codes developed by DOE (CASL and/or NEAMS developed, ANL codes for sodium fast reactors)
- **Identification of Experimental Data Needs**
  - Qualification of fuel behavior; analytical methods & data for assessment
  - Material performance at prototypical conditions
- **Participation in Codes and Standards Activities**

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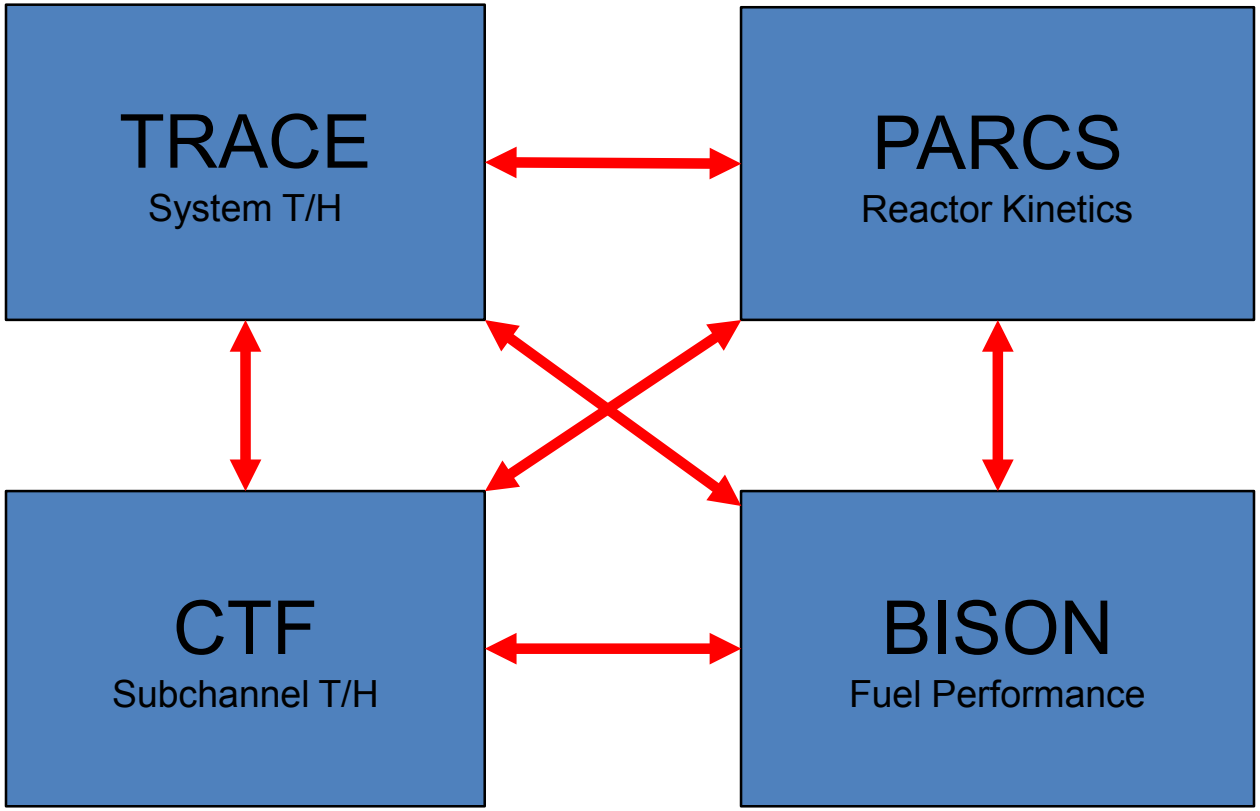
Sodium Fast Reactor Codes (Option 2)



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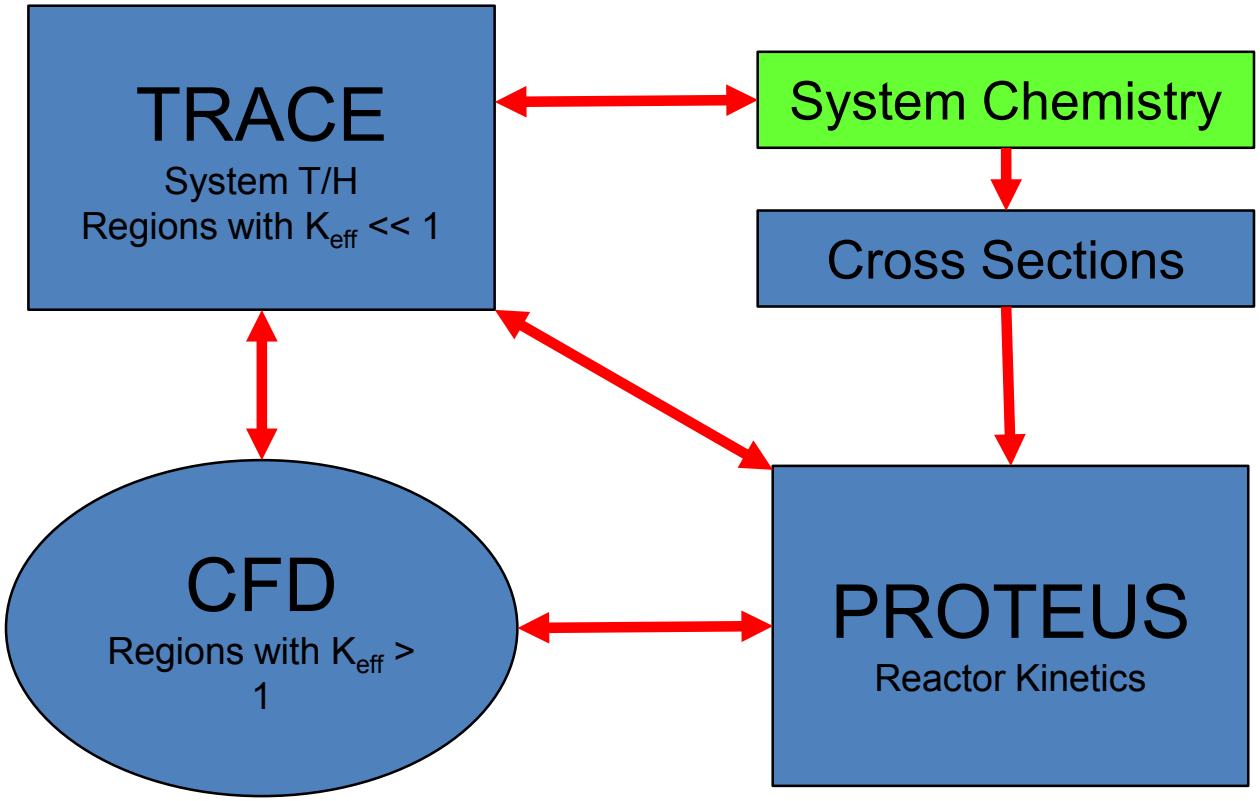
Molten Salt Reactor Codes (liquid fuel)



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Strategy 2: Computer Codes & Tools

Summary:

- Initial plan has been generated and the staff is prepared to begin development of tools & capability to perform the technical review.
- Activities currently limited by funding level and available resources.
- Familiarization with new designs is necessary to increase staff knowledge level.

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Strategy 3
(Flexible non-LWR regulatory review process)

Near-Term	Mid-Term	Long-Term
Develop guidance for a flexible non-LWR regulatory review process within the bounds of existing regulations, including the use of conceptual design reviews and staged-review processes.	Continue to develop guidance for a flexible non-LWR regulatory review process within the bounds of existing regulations, including the use of conceptual design reviews and staged-review processes. Initiate and develop a new non-LWR regulatory framework (if needed) that is risk-informed, performance-based, and that features staff review efforts commensurate with the risks posed by the non-LWR NPP design being considered.	Continue to develop, finalize, and promulgate a new non-LWR regulatory framework (if needed) that is risk-informed, performance-based, and that features staff review efforts commensurate with the risks posed by the non-LWR NPP design being considered.

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Strategy 3
(Near-Term Contributing Activities)

1) Document criteria for reaching safety, security, or environmental findings
2) **Determine and document appropriate non-LWR licensing bases and accident sets for highly prioritized non-LWR technologies.**
3) Identify, document and resolve (or develop plan to resolve) current regulatory framework gaps for non-LWRs.
4) **Develop and document a regulatory review "roadmap" that reflects the design development lifecycle and appropriate points of interaction with the NRC, and references appropriate guidance to staff reviewers and applicants.**
5) Update guidance for prototype testing, research and test reactors.
6) Licensing project plans and develop regulatory approaches commensurate with the risks posed by the technology.
7) Support longer-term efforts to develop, as needed, a new non-LWR regulatory framework

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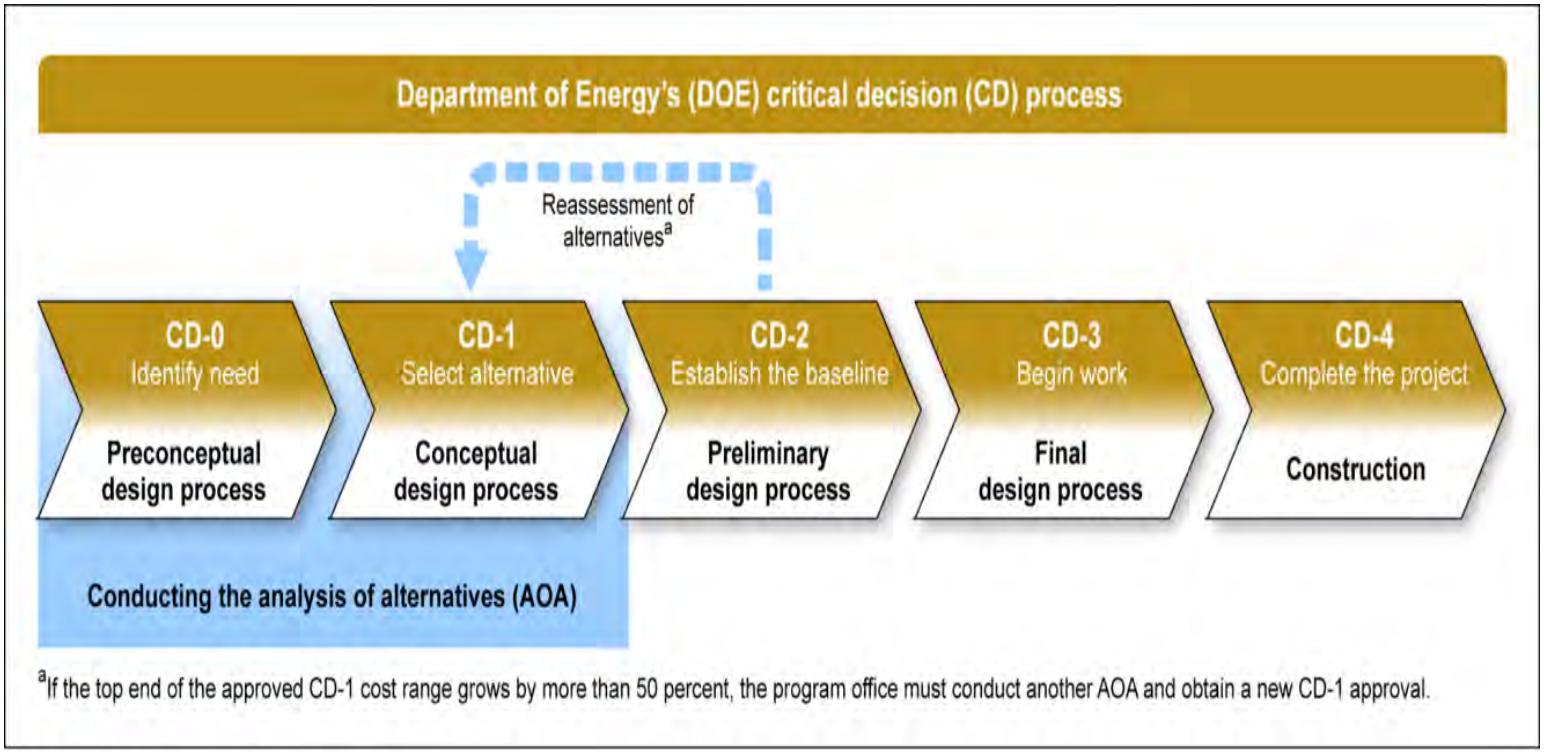
Strategy 3
(Activity 4: Flexible Approach, Roadmap)

DOE Critical Decision Process



Source: GAO analysis of DOE's Order 413.3B. | GAO-15-37

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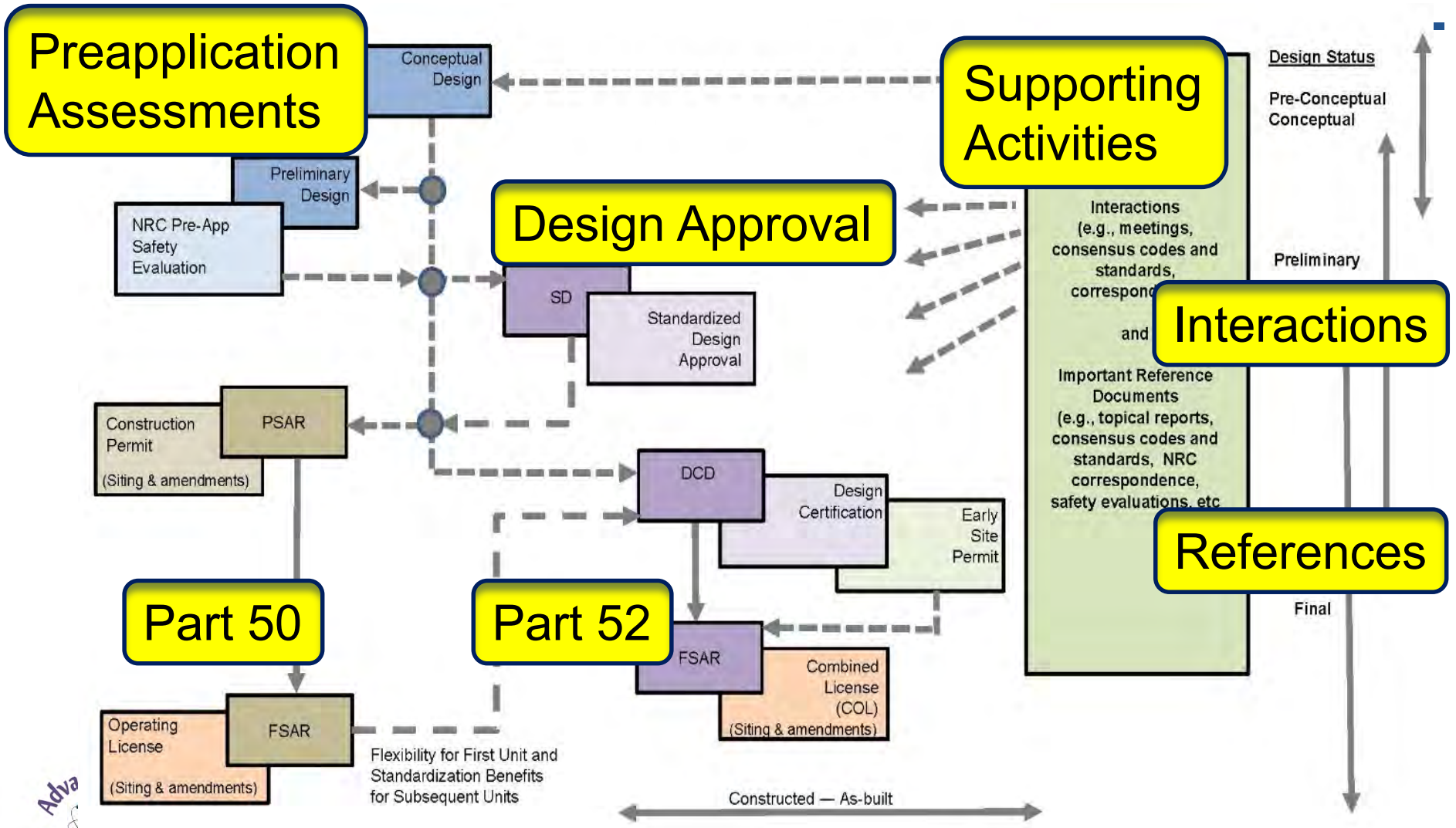
Flexible Approaches / Roadmap



Preliminary (preapplication) Design Assessments

All or selected topics to support critical decisions

- General Description of the Plant
- Site Characteristics
- Design of SSCs and Equipment
- Reactor
- Reactor Coolant and Connecting Systems
- Engineered Safety Features
- Instrumentation and Controls
- Electric Power
- Auxiliary Systems
- Steam and Power Conversion System
- Radioactive Waste Management
- Radiation Protection
- Conduct of Operations
- Verification Programs
- Transient and Accident Analyses
- Technical Specifications
- Quality Assurance and Reliability Assurance
- Human Factors Engineering
- Probabilistic Risk Assessment/Severe Accident Evaluation

RG 1.206 Chapters 1-19

- Emergency Planning
- Security
- Staffing
- Mitigating Strategies
- Aircraft Impact Assessment
- Environmental Report
- Financial
- Inspections, Tests, Analyses, and Acceptance Criteria
- Insurance
- Fuel Cycle
- Other (design or technology specific)

Other Parts of Applications & Possible Issues

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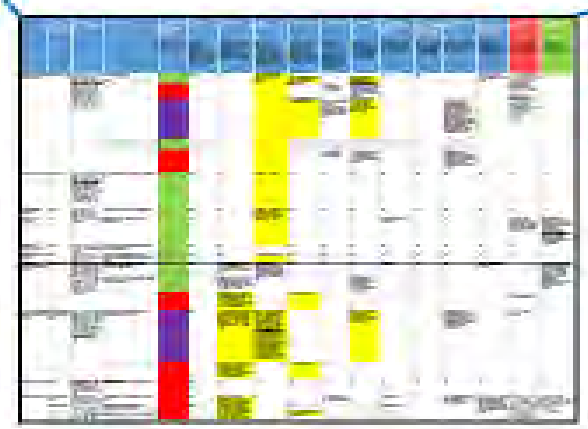
Enhanced Safety Focused Review for SMRs

Key Review Considerations

Safety-significance	Regulatory compliance	Novel design	Shared structures, systems, and components	Licensing approach

Safety margin	Defense-in-depth	Operational programs	Impact on safety functions	Additional risk insights	Other considerations

Review Tool



Output:

Scope and Depth of Review

- Provide supplemental approaches for implementation of NUREG-0800, Introduction - Part 2 and Design Specific Review Standard reviews
- Systematic thought process applicable to non-structure, system, or component and programmatic reviews

Advanced Reactor Program

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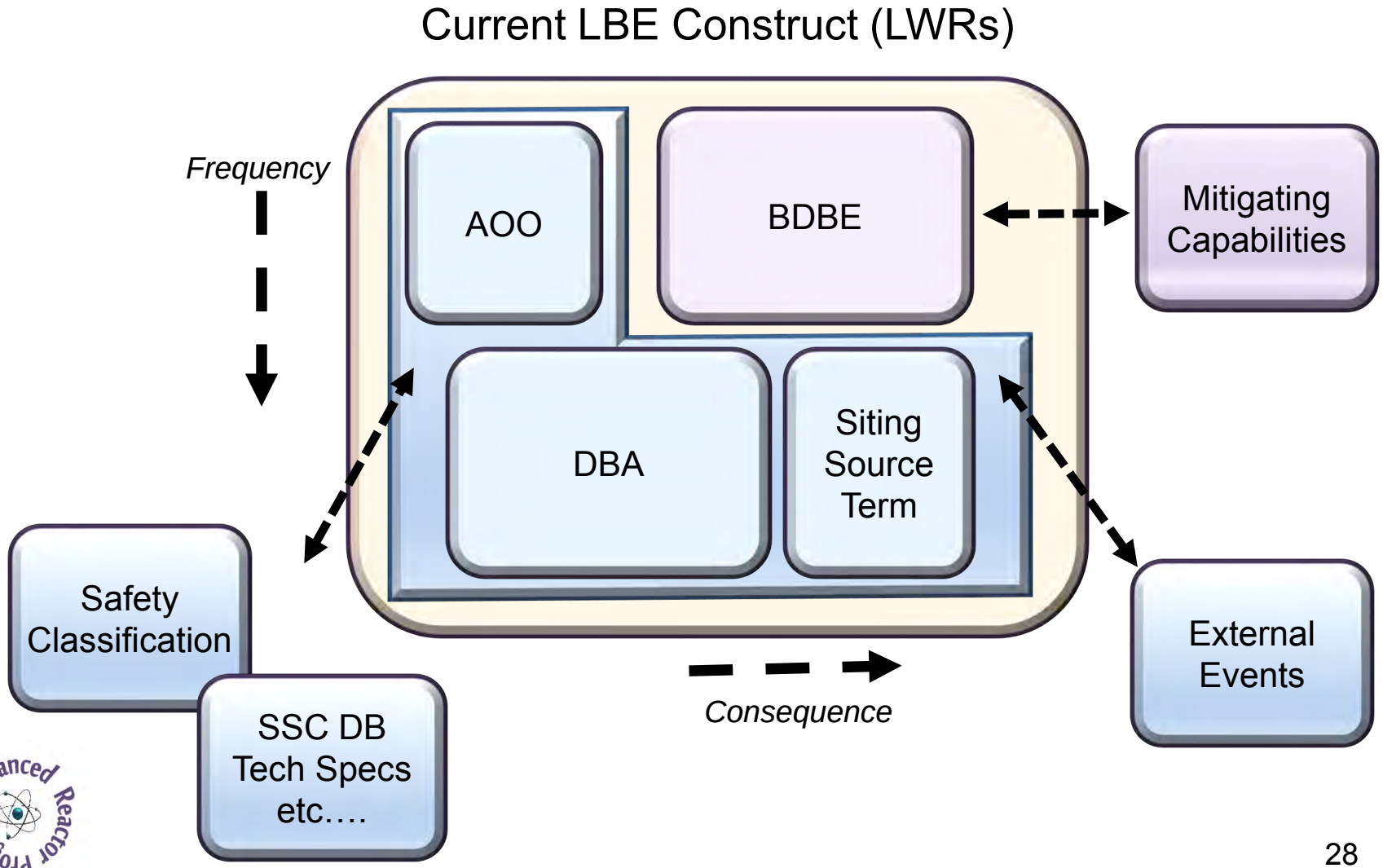
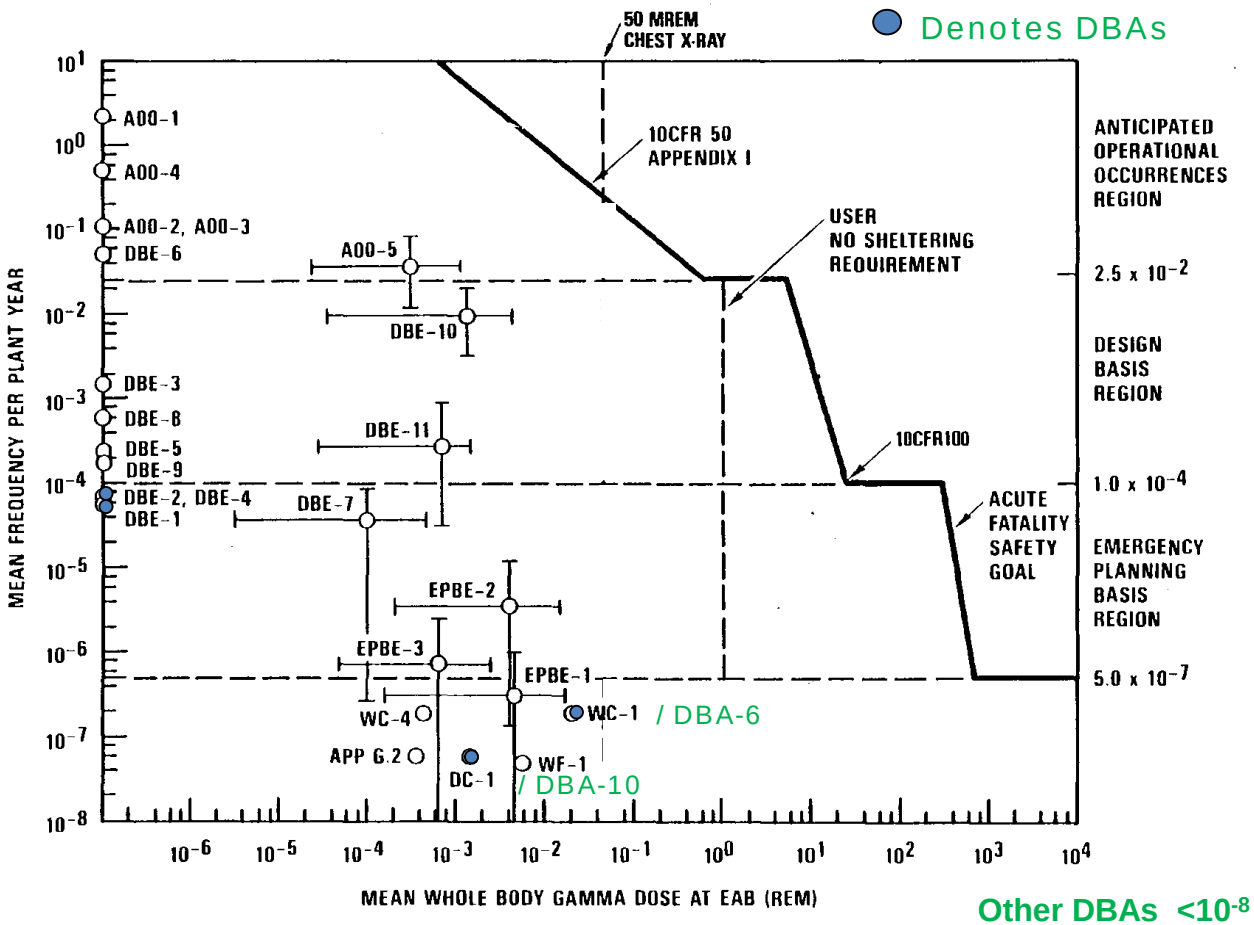
Strategy 3

(Activity 2: non-LWR licensing basis)



Strategy 3
(Activity 2: non-LWR licensing basis)

Example MHTGR LBEs, DBAs on F-C Plot (circa 1987)
(From 12/15/2016 NEI Presentation)



Licensing Basis Events
Other Considerations

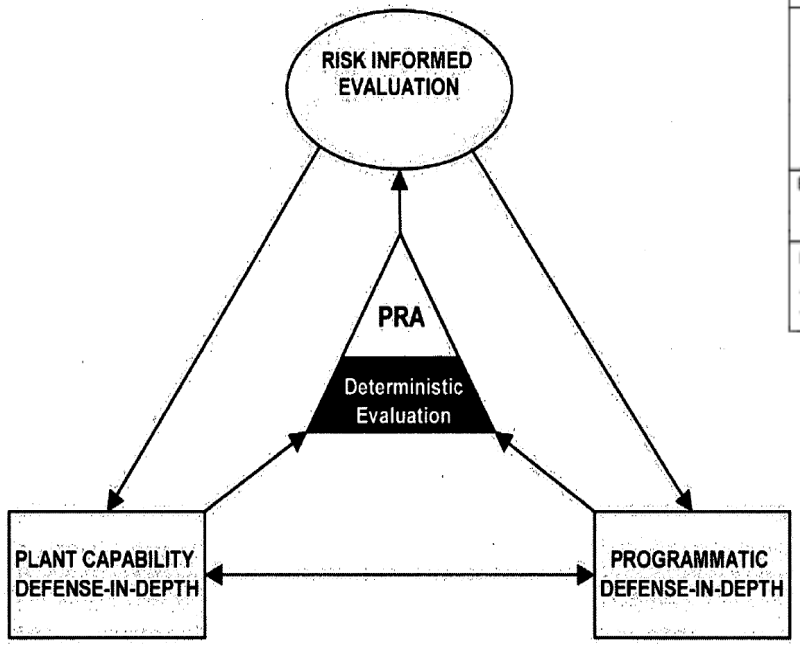


Figure E-1. Illustration showing the three major elements of the NGNP framework.

INL/EXT-09-17139
Next Generation Nuclear Plant
Defense-in-Depth Approach

Table 1-1
Safety Criteria and Analysis Requirements

Event	Region	No Fuel Melting	Fuel Cladding Integrity	Core Coolable Geometry	Primary Coolant Boundary Integrity	Containment Integrity	Radiation Dose at EAB and LPZ	Analysis Requirements
DBE	AOO	✓	✓	*	✓ ASME SL[1] "B," "C"	*	*	Conservative
	DBA	-	✓	✓*	✓ ASME SL "D"	✓	*	Conservative
Beyond DBE	ATWS	-	✓	✓*	✓ ASME SL "D"	✓	✓*	Best estimate plus uncertainties

Notes:
✓ Explicit safety criterion is defined.
* Meeting the safety criterion is expected if the previous criterion is met.
† SL = Service Level

From "4S Safety Analysis"
submitted by Toshiba Corporation, July 28, 2009
ADAMS Accession No. ML092170507

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Policy Issues

License for Prototype Reactors	Drafting white paper
License Structure for Multi-Module Facilities	SECY-11-0079
Appropriate Source Term, Dose Calculations, and Siting	SECY-16-0012
Offsite Emergency Planning (EP) Requirements	SECY-15-0077 Drafting Regulatory Basis
Annual Fees	Final Rule (May 2016)
Insurance and Liability	Evaluating for periodic report to Congress on Price-Anderson Act
Manufacturing License Requirements	SECY-14-0095 (SMRs)
Use of Probabilistic Risk Assessment in the Licensing Process	SRP Revisions (safety focused review)

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Policy Issues

Key Component and System Design Issues	Design Specific
Operator Staffing for Small or Multi-Module Facilities	SECY-11-0098 (flexibility w/ existing guidance)
Operational Programs for Small or Multi-Module Facilities	SECY-11-0112 (flexibility w/ existing guidance)
Installation of Reactor Modules During Operation of Multi-Module Facilities	SECY-11-0112 (existing guidance)
Industrial Facilities Using Nuclear-Generated Process Heat	SECY-11-0112 (assess as necessary)
Decommissioning Funding Assurance	SECY-11-0181 (Site-specific exemptions)
Implementation of Defense-In-Depth (DiD) Philosophy for Advanced Reactors	SECY-15-0168 (part of licensing framework)

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Policy Issues

Security and Safeguards Requirements for SMRs	Ongoing discussions (NEI White Paper)
Aircraft Impact Assessments	Ongoing discussions
Licensing Basis Event Selection	Ongoing discussions
Functional Containment Performance Criteria	Ongoing discussions
Fuel qualification, materials qualification	Issues vary by technology
Fuel cycle facilities, enrichments	Ongoing discussions
Continuing efforts to identify and prioritize technical and policy issues	

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Next Steps

- ACRS Feedback
- Upcoming milestones
- Future engagement with ACRS

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Acronyms & Abbreviations

ANL	Argonne National Laboratory
ANS	American Nuclear Society
AOO	Anticipated operational occurrence
ASME	American Society of Mechanical Engineers
BDBE	Beyond-design-basis event
BPVC	Bolier and Pressure Vessel Code
CASL	Consortium for Advanced Simulation of Light Water Reactors
COL	combined license
DB	Design basis (SSC)
DBA	Design-basis accident
DBE	design-basis event
DCD	design control document
DOE	Department of Energy
EP	Emergency Preparedness
FSAR	final safety analysis report
GAIN	Gateway for Accelerated Innovation in Nuclear (DOE)

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Acronyms & Abbreviations

IAP	Implementation Action Plan
INL	Idaho National Laboratory
LBE	licensing basis event
LWR	Light Water Reactor
MOU	Memorandum of Understanding
NEAMS	Nuclear Energy Advanced Modeling and Simulation (DOE)
non-LWR	Reactors not cooled/moderated by light water
NRC	Nuclear Regulatory Commission
ONT	Other nuclear technologies
ORNL	Oak Ridge National Laboratory
PRA	Probabilistic risk assessment
PSAR	preliminary safety analysis report
SD	Standard design
SMR	Small modular reactor (NRC use limited to LWRs)
SSC	structure, system, and component
V&S	Vision and Strategy

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References (Public Versions)

	NRC VISION AND STRATEGY, NON-LWR MISSION READINESS	ML16356A670
	NEAR-TERM IMPLEMENATION ACTION PLANS, VOLUME 1	ML16294A181
	NEAR-TERM IMPLEMENATION ACTION PLANS, VOLUME 2	ML16334A495
	MID- AND LONG-TERM IMPLEMENATION ACTION PLANS	ML17054D483
	DRAFT REGULATORY REVIEW ROADMAP	ML16291A248
SECY-10-0034	POTENTIAL POLICY, LICENSING, AND KEY TECHNICAL ISSUES FOR SMALL MODULAR NUCLEAR REACTOR DESIGNS	ML093290268
SECY-11-0079	STAFF ASSESSMENT OF SELECTED SMALL MODULAR REACTOR ISSUES IDENTIFIED IN SECY-10-0034	ML110460434
SECY-11-0098	OPERATOR STAFFING FOR SMALL OR MULTI-MODULE NUCLEAR POWER PLANT FACILITIES	ML111870574
SECY-11-0112	STAFF ASSESSMENT OF SELECTED SMALL MODULAR REACTOR ISSUES IDENTIFIED IN SECY-10-0034	ML110460434
Secy-11-0181	DECOMMISSIONING FUNDING ASSURANCE FOR SMALL MODULAR NUCLEAR REACTORS	ML112620358
Secy-14-0095	STATUS OF THE OFFICE OF NEW REACTORS READINESS TO REVIEW SMALL MODULAR REACTOR APPLICATIONS	ML14073A710
Secy-15-0077	OPTIONS FOR EMERGENCY PREPAREDNESS FOR SMALL MODULAR REACTORS AND OTHER NEW TECHNOLOGIES	ML15037A176
Secy-15-0168	RECOMMENDATIONS ON ISSUES RELATED TO IMPLEMENTATION OF A RISK MANAGEMENT REGULATORY FRAMEWORK	ML15265A488
Secy-16-0012	ACCIDENT SOURCE TERMS AND SITING FOR SMALL MODULAR REACTORS AND NON-LIGHT WATER REACTORS	ML15309A319

Proposed RES Activity Support for FY17

This document discusses the proposed NRC Office of Research support activities in the following areas and is available in ADAMS under ML17076A147:

- Neutronics and Kinetics
- Fuel Performance
- Thermal-Hydraulics
- Severe Accident Phenomena
- Offsite Consequence Analysis
- Materials Research
- I&C
- Human and Organizational Factors (on hold)
- PRA
- Internal & External Hazards (on hold)

DOE Program Input Associated with NRC's Draft Implementation Action Plan

ACRS Future Plant Designs Subcommittee

Office of Nuclear Energy
U.S. Department of Energy

March 8, 2017

DOE Vision and Strategy

- DOE recently issued its "VISION and STRATEGY for the Development and Deployment of Advanced Reactors"
- https://energy.gov/ne/downloads/vision-and-strategy-development-and-deployment-advanced-reactors
- Aligned with NRC's Implementation Action Plan (IAP)
- Incorporates feedback from industry's review of May, 2016 draft
- Includes a near term focus on an NRC regulatory framework being established for advanced non-LWRs

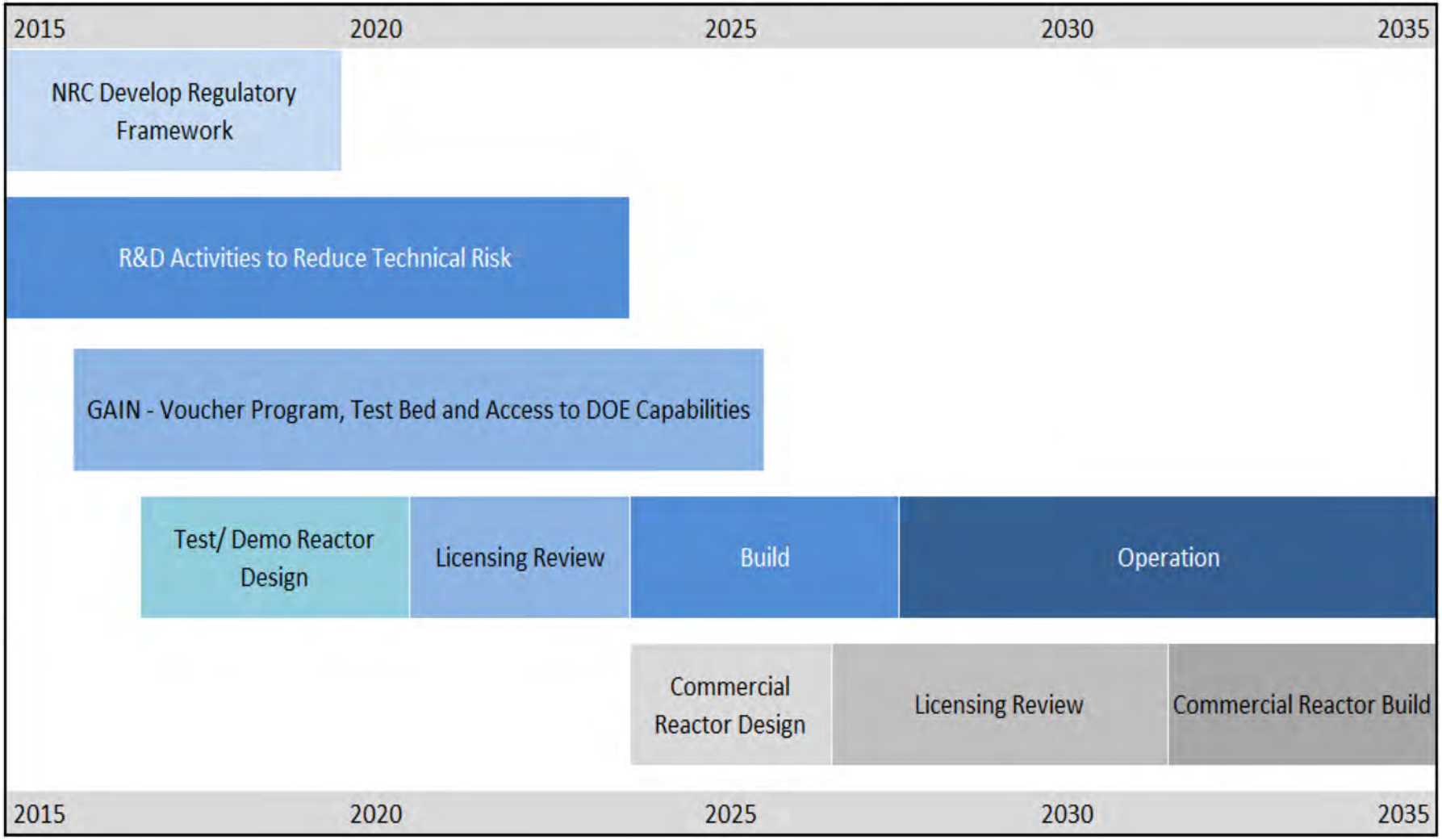
DOE Office of Nuclear Energy: Priorities & Focus Areas

- Accelerate deployment of advanced nuclear energy technologies
  - Partner with industry and universities for the development and deployment of advanced and innovative nuclear energy reactors, systems, and technologies
  - Expand transfer of lab-developed technologies to the commercial private sector

- Enable commercial deployment of light water-based SMRs by the mid-2020's

- Enable commercial deployment of advanced non-LWRs by the 2030's

DOE Vision: Sequence Supporting Advanced Reactor Deployment

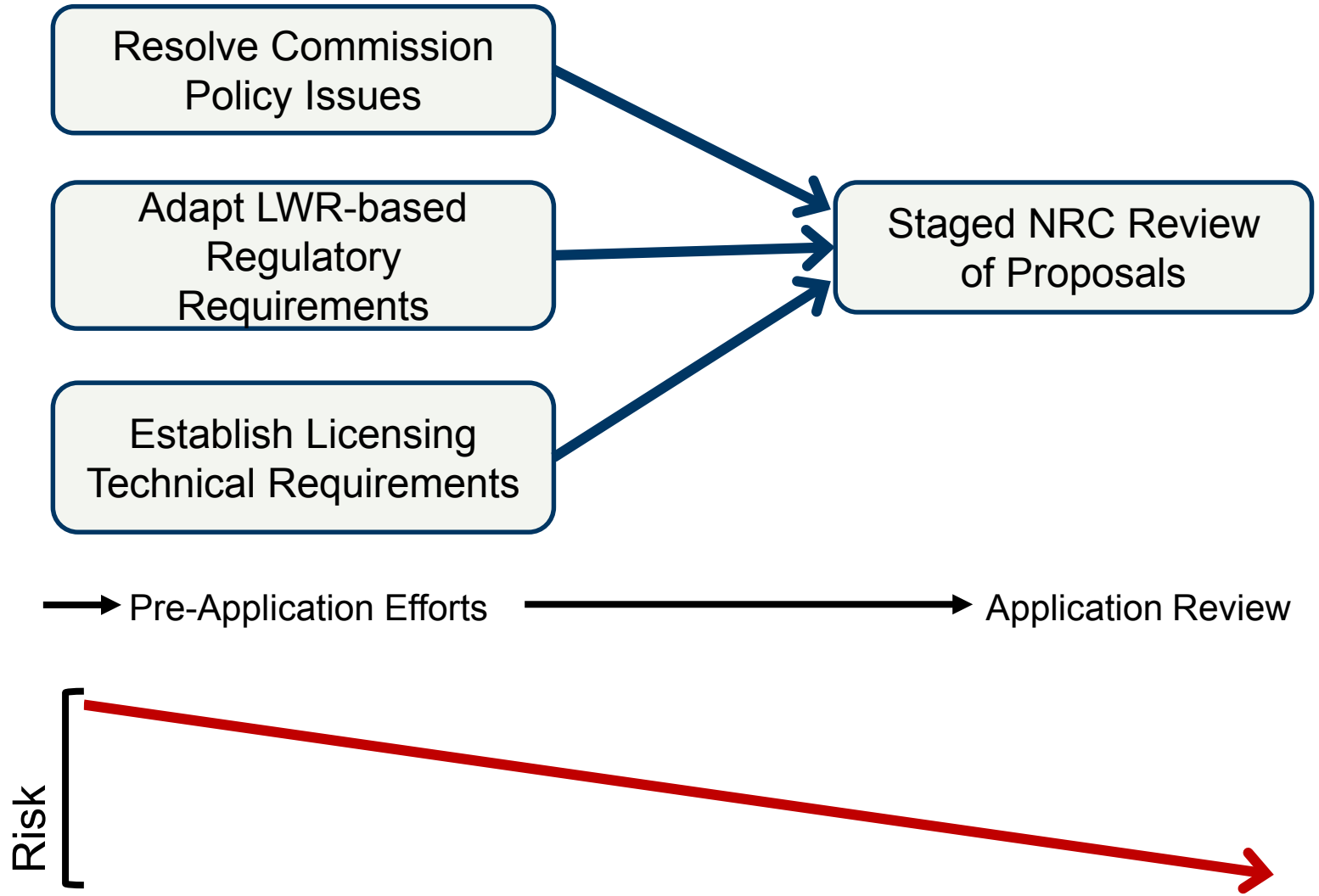


DOE's View of the "Regulatory Framework" Needed to Support Near-Term Deployment

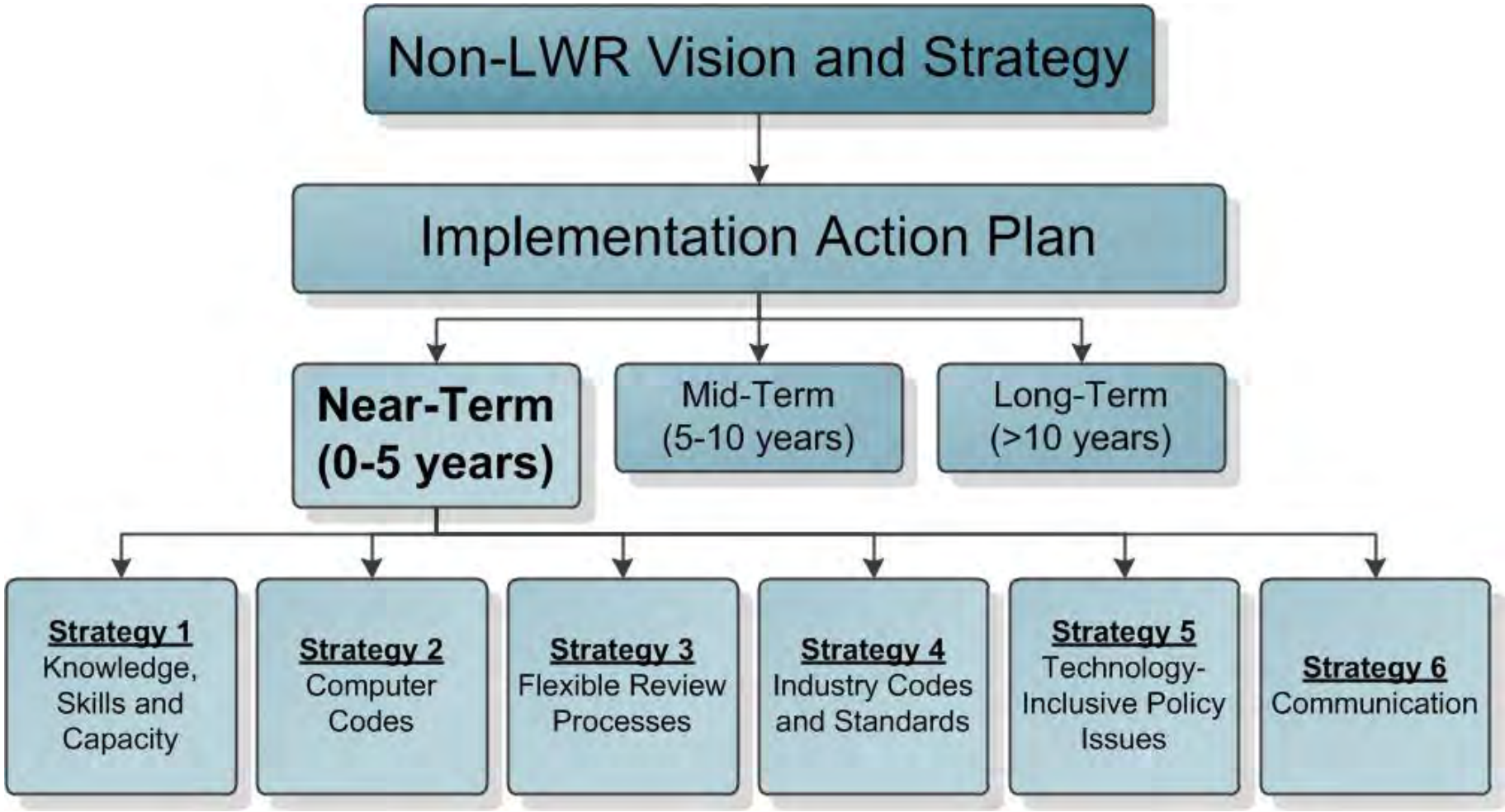
- Elements of the regulatory framework needed to increase regulatory certainty for near term deployment include:
  - **Identify and resolve key Commission policy issues**
  - **Adapt LWR-based regulatory requirements to advanced non-LWRs**
    - Informed by results of DOE's focused R&D activities
  - **Establish Licensing Technical Requirements**
    - Enhanced by development of industry consensus Codes and Standards
  - **Establish staged/phased review processes**

- Near term advanced reactor deployment does not require the establishment of an entirely new regulatory framework (i.e., "Part 53")
- Pilot work by industry, in conjunction with NRC's near term IAP efforts, can inform future, longer term "Part 53" development

DOE Supporting Focused Retirement of Regulatory Risk



NRC's Near-Term Implementation Action Plans

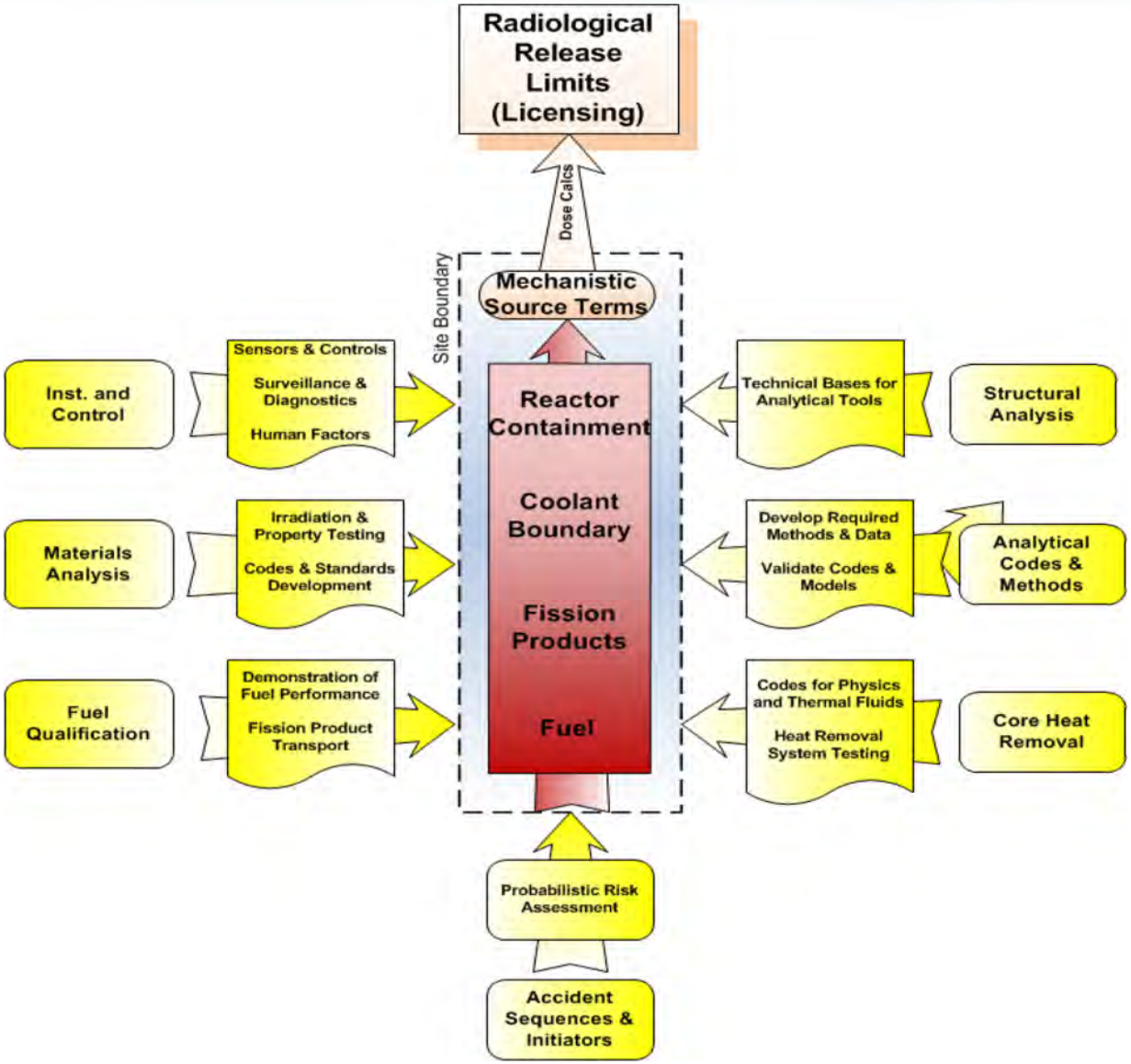


Industry Inputs to DOE

DOE seeks industry input on regulatory framework needs and deployment support priorities from a number of sources:

- Industry insights provided via DOE's GAIN Initiative to increase coordination, collaboration, and access to the national laboratory complex
  - Ex.: GAIN-EPRI Modeling and Simulation workshop (January 2017)
- DOE and national lab team participation in NEI efforts
  - NEI Advanced Reactor Working Group
  - NEI Advanced Reactor Regulatory Task Force
- Nuclear Innovation Alliance interactions
- Nuclear Infrastructure Council interactions
- EPRI and ANS interfaces
- Industry presentations at DOE-NRC Advanced Reactor Workshops
- DOE's Technical Review Panel

Key Inputs for Licensing (Typical)



Resolve Open Commission Policy Issues and Establish Licensing Technical Requirements

- DOE engaged in Commission policy issue resolution
  - Support for utility-led Licensing Technical Requirements Modernization Project
  - Participation in NEI's Advanced Reactor Regulatory Task Force
- DOE working with industry to develop advanced reactor licensing technical requirements, for example:
  - DOE-NRC joint initiative addressing adaptation of the LWR-based General Design Criteria (10 CFR 50 App. A) for non-LWRs
  - Advanced fuel testing and mechanistic source term development
  - Passive cooling system testing
  - Advanced material testing
  - DOE/national lab team pilot study on potential adaptations of the LWR Standard Review Plan to address advanced non-LWRs (SFRs and HTGRs)

IAP Strategy 5 Feedback: Recent NRC efforts to establish regular public meetings with industry and DOE/lab team in a "working group" format are key to timely and efficient regulatory framework development

Industry-Informed Analytical Tools Development

- NRC IAP approach is to leverage industry collaboration and cooperation in establishing a set of commonly understood and accepted tools
  - Community includes NRC, DOE, vendors, utilities, and international regulatory partners

- DOE national labs have significant capabilities in this area, with additional tools under development
  - Industry, DOE/national labs, and NRC need to efficiently leverage resources and priorities, while avoiding conflicts

IAP Strategy 2 Feedback: Close coordination with industry stakeholders and DOE national laboratories is key to efficient path forward

Industry Codes and Standards

- Industry, DOE, and NRC recognize the lack of consensus standards necessary to support the efficient licensing of advanced non-LWRs
- NRC's IAP indicates that it will work with industry to identify existing gaps, then participate with the Standards Development Organizations in developing codes and standards to address them
- DOE and the national lab teams are currently performing a pilot study to determine how to most efficiently address this critical need
  - Obtain a list of all standards used in the regulatory process
  - Select a few standards for an in-depth review (SFR pilot)
  - Develop estimated timelines for completion based on pilot sample set

IAP Strategy 4 Feedback: Close coordination with industry stakeholders and DOE national laboratories is key to efficient path forward

Staged Regulatory Review Options

- DOE is supporting review options development through its industry group engagement through industry groups
  - Nuclear Innovation Alliance (NIA)
  - Nuclear Energy Institute (NEI)
  - Nuclear Infrastructure Council (NIC)

- DOE is prepared to provide further insights from its staged Critical Decision (CD) process for major projects
  - CD process is briefly summarized in Strategy 3 of NRC's IAP

IAP Strategy 3 Feedback: DOE will continue its indirect support of industry's interactions with NRC to establish staged reactor design review options

Regulatory Improvements in Advanced Reactor Designs

ACRS Meeting On Advanced Reactors Licensing

Jeffrey S. Merrifield, Chairman Advanced Reactors Task Force (USNRC 2007-2012)
David Blee, Executive Director USNIC

U.S. Nuclear Infrastructure Council

March 8, 2017

Overview

- The Nuclear Infrastructure Council ("NIC") commends the Advisory Committee for Reactor Safety ("ACRS") for convening this meeting
- We appreciate the opportunity to share our views on the matter of Advanced Nuclear Reactors
- NIC serves as a leading advocate for Advanced Reactor technologies representing 14 different Advanced Non-Light Water Reactor developers
- We appreciate the progress the NRC has made on Advanced Reactor licensing and support the progress made on Advanced Reactor Design Criteria
- NIC's comments today will provide our thoughts about the NRC Advanced Reactor licensing process as well as focus on the December 2016 Vision and Strategy document and the Mid-Term and Long-Term Implementation Action Plans

United States NIC Nuclear Infrastructure Council

Timing

- While the maturity of the Advanced Reactor designs vary among our members, NIC believes the deployment of these reactors could occur in the late 2020s
- We remain concerned that DOE remains focused on deployment of Advanced Reactors in the “early 2030s” and underestimates the speed at which these designs are moving
- While NIC appreciates and supports the degree with which the NRC and DOE are collaborating, we remain concerned about the NRC Strategic Goals being tied to the “DOE Non-LWR Vision and Goals Alignment Point” (See Mid/Long Term IAP)
- One NIC member, Terrestrial Energy has indicated that it will be seeking a design review with the NRC in 2019
- Multiple Advanced Reactor designs will seek licensing review in the next few years, and the NRC must be prepared

NRC – No Longer Regulator of First Resort

- NIC is concerned that the increasing complexity and reduced timeliness of NRC licensing actions over the last 10 years has incentivized innovators to seek alternative licensing pathways
- At least four NIC members will seek pre-licensing vendor design review by the Canadian Nuclear Safety Commission (CNNC)
- CNNC pre-licensing vendor design review allows early assessment of a design to surface potential concerns and validate potential licensability – significant benefit to developers
- NRC should adopt a process of pre-licensing review similar to CNNC

Pre-Licensing Vendor Design Review

- The CNNC process allows pre-licensing regulatory feedback on the designs in a defined period of time and under a defined cost
- The CNNC process allows the applicant to understand the licensability of the design – prior to seeking a full-blown design review
- This “licensability” determination provides additional certainty for investors who may wish to invest in these designs
- NIC has urged the NRC staff to consider emulating the CNNC process to spur Advanced Reactor innovation in the U.S.
- NIC is also supportive of additional funding - $10 million in off-the-fee-base funding in FY2018 to support the development of NRC licensing capabilities for Advanced Reactors

Action Going Forward

- While NIC will provide specific comments on the Vision and Strategy Documents, we believe that overall, the staff is headed in the right direction – particularly on reactor design issues
- NIC has raised its concern that potentially insufficient attention to fuel issues could be problematic
- Many Advanced Reactor designs utilize higher-assay LEU, and the Office of Nuclear Materials Safety and Safeguards ("NMSS") will need to be actively engaged with a variety of fuel cycle issues
- In reviewing the Vision and Strategy documents, NIC recognizes insufficient attention regarding the timeliness of environmental reviews
- Due to the reduced source term of many Advanced Reactor designs, there is significant potential to reduce the time and expense for environmental reviews – an important opportunity that shouldn't be missed

NRC Vision and Strategy December 2016

- On page 1 of the Executive Summary, the staff states that the NRC recognizes that "non-LWR vendors may wish to commence pre-application activities or submit applications for review in the near-term, in advance of DOE's deployment goal."
- NIC believes it is positive that the NRC is not tying itself to the DOE deployment goal
- On page 7, the document discusses the use of computer models and analytical resources and indicates that "the emphasis in the staff's approach is to leverage, to the maximum extent practical, collaboration and cooperation…with the goal of establishing a set of tools and data that are commonly understood and accepted" NIC supports an approach that maximizes collaboration and minimizes cost and duplication
- On page 7, the staff emphasizes the need to identify policy decisions appropriate to govern the acceptability of non-LWR designs and recognizes several of these as well as some which may apply to both LWR and non-LWR designs
- NIC supports the need to readily identify these policy issues and will be working with its Advanced Reactors Technology Owners Group to provide a prioritized roadmap to the NRC staff later this month

NRC Vision and Strategy (2)

- On page 9, NIC appreciates the change in the document recognizing the role that NIC plays in representing the Advanced Reactor community
- However, also on page 9, NIC continues to be concerned regarding the language discussing the prioritization of review and the NRC identification of which “particular technologies are more likely to become ready for the agency’s regulatory reviews”
- NIC continues to believe that the role of the Agency is to establish a set of risk informed performance based licensing requirements that are to the extent practicable, technology neutral and provide a framework for various Advanced Reactor technologies to move forward
- NIC is concerned with this language because it leaves the impression that the Agency may attempt to make a qualitative judgement about various reactor vendors. NIC’s view is that as long as the applicant meets the NRC requirements and pays the applicable fees, it should have the opportunity to have its design reviewed in a timely fashion
- If the NRC needs additional resources to review these designs, the Commission should seek the appropriate funding from Congress and the Trump Administration to cover these tasks

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Medium and Long Term IAP

- Overall, NIC believes the Medium and Long Term IAP appear to be a logical framework. Our comments today are general in nature – specific comments will be provided later
- NIC recognizes that the NRC Commission and Staff remain steadfast in their view that the "Agency is Ready to Accept an Advanced Reactor Design for Review"
- Yet, page 3 of the IAP repeats the strategic goal of the NRC "being ready to effectively and efficiently review and regulate non-LWRs by not later than 2025"
- We are concerned about this lack of timeliness and believe the Agency must seek the resources and people to accelerate its readiness
- NIC remains concerned about funding issues associated with Advanced Reactors and continues to support fee relief – off-the-fee-base – to allow more detailed discussions between technology developers and the NRC before fees begin to be imposed
- NIC would welcome the Commission taking a more active role in supporting a change in this specific fee requirement
- We look forward to continuing to work with the Agency to identify ways to enable the deployment of Advanced Reactors through a timely, risk-informed, performance-based licensing process consistent providing adequate protection to the public

United States NIC Nuclear Infrastructure Council

Closing

- NIC appreciates the opportunity to participate in this meeting and looks forward to our continuing involvement in these discussions
- We appreciate the progress the NRC staff have made in focusing on these issues and devising a roadmap which will enhance the ability of the Agency to review and license these innovative Advanced Reactor technologies
- As discussed, our main concerns in this process are timing -- we believe this process is moving faster than people think -- and money -- more off the fee based funding is needed to review these designs
- We appreciate the attention ACRS is giving to Advanced Reactor designs and thank you for allowing NIC to testify on these important matters
- Given the speed at which these issues are moving, we believe the ACRS input is useful for what we hope is a near term discussion with the Commission on the matter of Advanced Reactor designs

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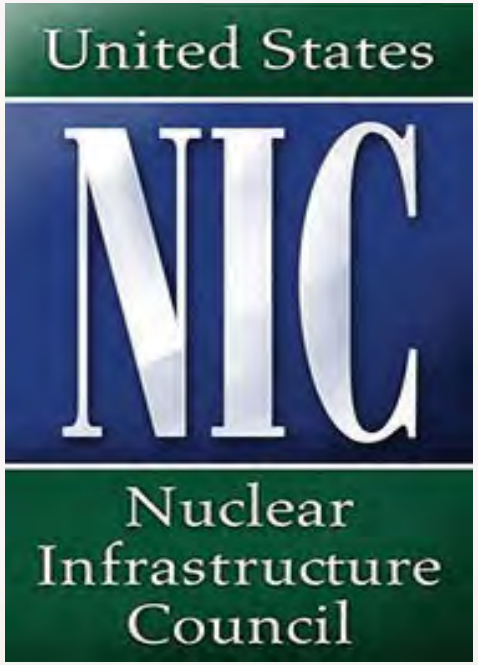


For more information visit www.usnic.org

U.S. Nuclear Infrastructure Council
1317 F Street, NW – Suite 350 – Washington, DC 20004
(202) 332-8155

About the USNIC

- Leading business consortium advocate for increased U.S. nuclear use and global deployment of U.S. nuclear technologies and services
- Represents 100 member companies encompassing wide representation of the nuclear energy supply chain and key movers
- Member of the Civil Nuclear Trade Advisory Committee
- Strongly supports Gen 3+ reactors, small modular reactors and advanced reactors moving in parallel paths
- Organizer of the 2017 Advanced Reactors Technical Summit IV & Technology Trailblazers Showcase which occurred on February 8-9 at Argonne National Laboratory

Industry Comments on NRC's Non-LWR Near Term Implementation Action Plans

ACRS Future Plant Design Subcommittee Meeting

March 8, 2017

Michael Tschiltz

NEI

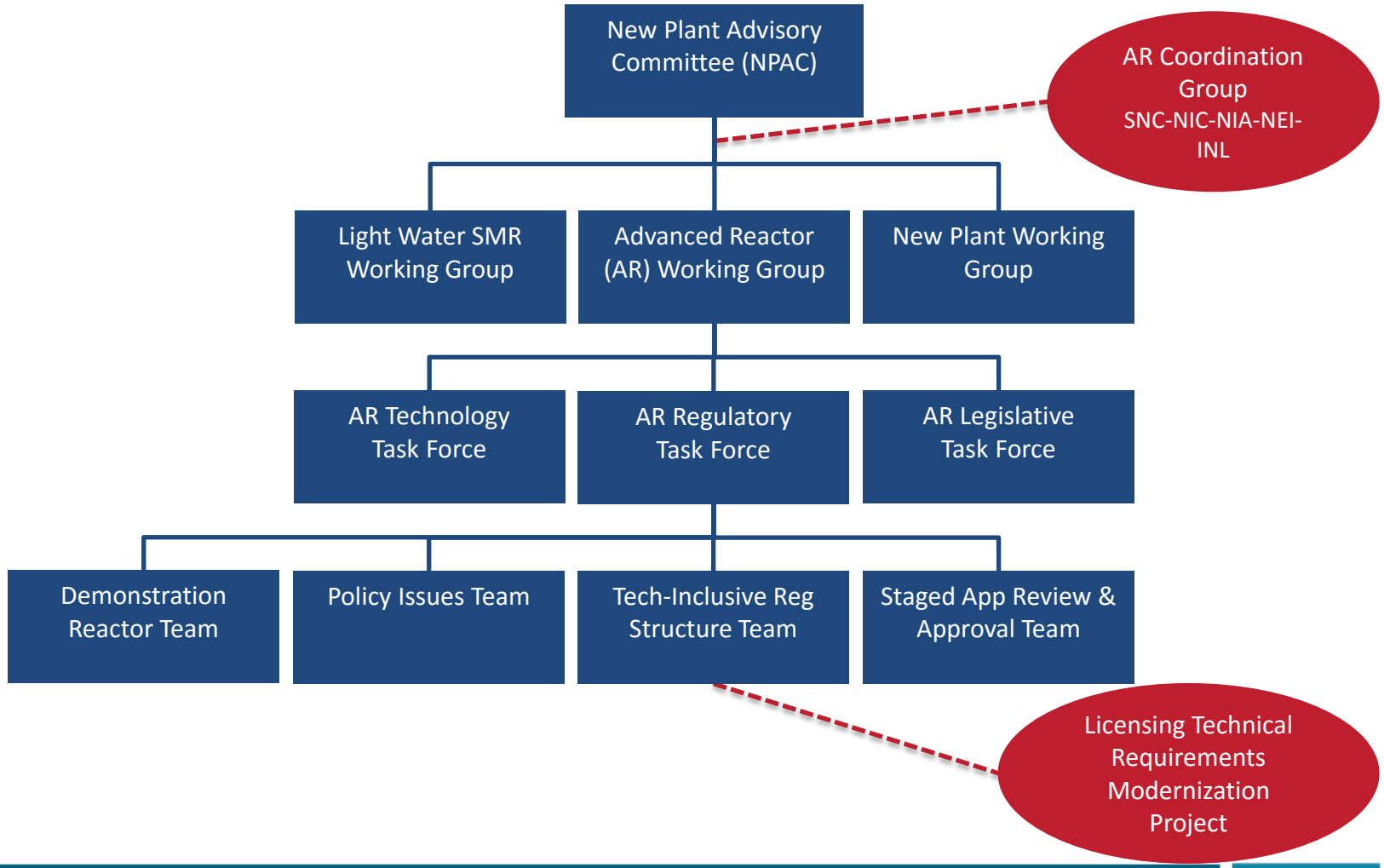
Director of New Plant, SMR and Advanced Reactors

NRC's Non-LWR Vision and Strategy

NRC's non-LWR readiness activities in the near-term Implementation Action Plan (IAP) are an important step to enhance NRC's technical and regulatory readiness for licensing advanced reactors.

- The IAP improves the transparency of NRC activities in support of licensing Advanced Non-LWR technologies.
- Need to utilize the IAP in a manner that results in a more efficient and effective licensing process.
- Need to develop detailed tasks, work plans (Phase 2). NEI/Industry is ready to work closely with the staff to support Phase 2.
  - Phase 2 needs to integrate readiness timelines from different activities to identify critical path activities and allocate resources appropriately.
  - Phase 2 should include the prioritization of efforts necessary to best utilize available resources.
  - Phase 2 needs to address how the IAP will be maintained as a "living plan."

NEI/Industry Structure for Advanced Non-LWR Activities



Important near-term activities

- **Align design, research and regulatory processes**
  - Identify technology-inclusive policy issues and/or any gaps in the existing regulatory framework early in the process.
  - Place a high priority on the development of technology or design-specific licensing project plans that identify information needed for to support staff findings.
  - Align activity timelines/resources with industry needs.

Comments on Strategy 3

- **Strategy No. 3 – Develop guidance for a flexible non-LWR regulatory review within the bounds of existing regulations…**

  - Contributing Activity 3.1 - Develop Decisionmaking Criteria
    - It is important to identify aspects of non-LWR design where it is possible to satisfy existing acceptance criteria for reaching a safety, security or environmental finding.
    - If new acceptance criteria are identified efforts should focus on establishing technology neutral criteria to address the wide range of non-LWR designs.
    - The Advanced Reactor Policy Statement includes as a goal for *"future plants that security be better incorporated into the plant design."* The IAP would benefit from NRC clarifying it's intent to address this goal in the near-term IAPs in connection with the Security Design considerations.

Comments on Strategy 3

- **Strategy No. 3 – Develop guidance for a flexible non-LWR regulatory review within the bounds of existing regulations…**

  - Contributing Activity 3.3 – Identify Gaps in Regulatory Framework
    - Near-term fuel cycle activities should be included that address design and qualification of non-LWR fuel and related issues (e.g., uranium enrichments above 5%, material control & accounting, security and transportation).

  - Contributing Activity 3.4 – Develop regulatory review roadmap
    - expected level of design detail required as part of an accepted design certification application has expanded over time.
    - advanced reactor stakeholders would benefit from guidance that outlines the acceptable level of detail needed at each point of a staged licensing approach.

  - Detailed comments are included in an NEI letter to the staff dated 3/6/17.

Conclusions

- Industry anxious to support meaningful progress.
- Need to continue to use the IAP to identify, document and allocate resources to areas where additional work is needed.
- Need to enhance the regulatory framework through utilizing the efforts of the utility-led Licensing Modernization Project.
- Identify where focused efforts from outside NRC are needed during implementation.

Removing Barriers for Advanced Reactor Deployment Through Modernization of Regulatory Framework

Amir Afzali

Licensing and Policy Director – Next Generation Reactors

Southern Company Services

ACRS Future Plant Designs Subcommittee

March 8, 2017

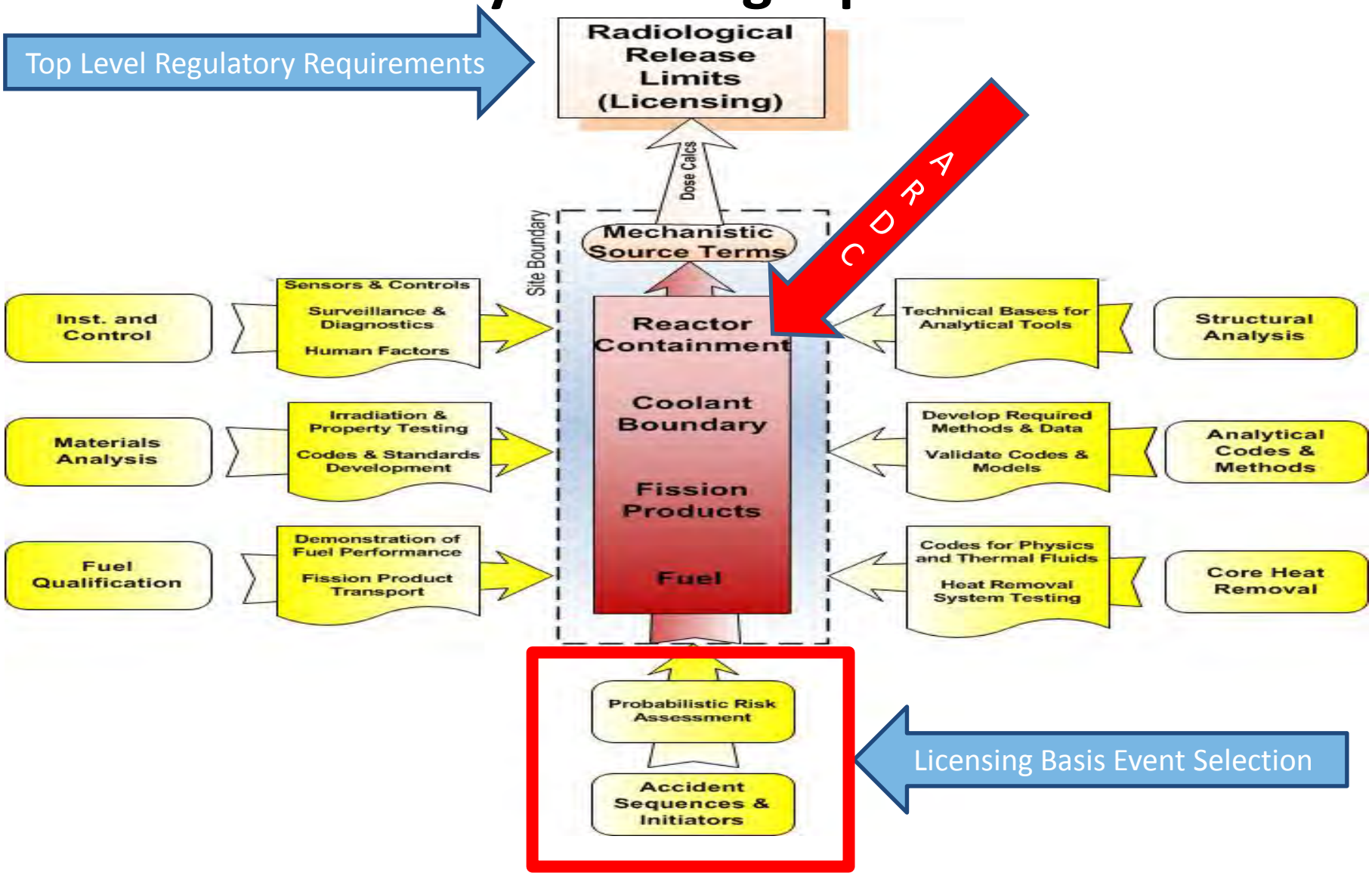
Southern Company

Observations and Recommendations

- Observations:
  - IAPs provide a comprehensive list of needed activities
  - It is not clear that the near term actions reduce licensing risk adequately in a timely manner.
  - The need for a Risk-Informed, Performance-Based (RIPB) licensing structure for advanced non-LWR reactors was identified many years ago (1990s) and has been reemphasized recently (e.g., SECY- 15-0168) yet the NRC projected time lines for developing RIPB are well into the future (2026+)
- Recommendations:
  - Strategies 3 and 5 should be given the highest priority, particularly the Licensing Basis Event (LBE) Selection Process.
  - Staff engagement with the industry to develop a systematic Technology Inclusive Risk-Informed, Performance-Based (TI-RIPB) LBE selection process should be supported.
    - Build on over 20 years of previous work by industry, NEI, and NRC such as NGNP, NUREG 1860, ANS standard ANS 53.1 ("Nuclear Safety Criteria for the Design of Modular Helium Cooled Reactor Plants"

Southern Company

Key Licensing Inputs



Addressing LBE selection should be top priority because it is the basis for all other licensing inputs

The Key Consideration

- SRP Chapter 15.0 statement:

  *"If **the risk of an event** is defined as the product of **the event's frequency of occurrence and its consequences**, then the design of the plant should be such that all the AOOs and postulated accidents produce about the same level of risk (i.e., the risk is approximately constant across the spectrum of AOOs and postulated accidents). This is reflected in the **general design criteria (GDC), which generally prohibit relatively frequent events (AOOs) from resulting in serious consequences, but allow the relatively rare events (postulated accidents) to produce more severe consequences**."*

- Conclusion: To meet this requirement LBE Selection has to be RIPB
- Options: Ad hoc RIPB Approach vs. Systematic RIPB Process

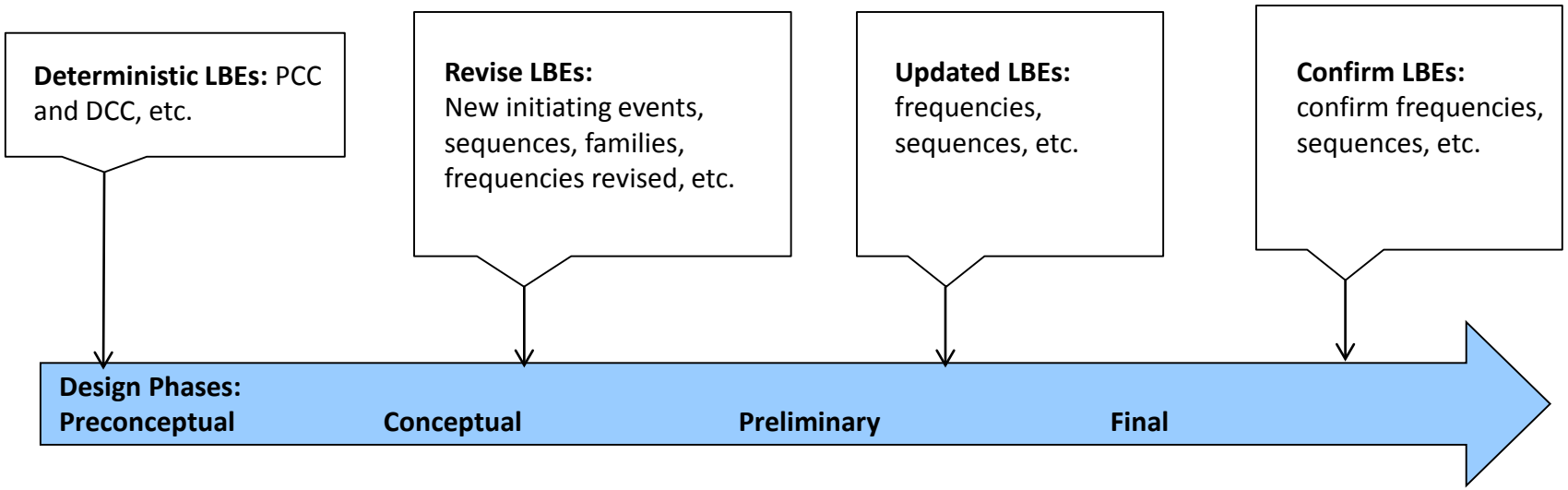
Southern Company

Comparison of Options for the LBE Selection Process

LBE Selection Options	Process	Tools used for identification and consequence analysis	Frequency estimate	Uncertainty Analysis	Technical Adequacy
Ad Hoc RIPB	Events are identified and analyzed based on Engineering Judgment; revised to reflect service experience	Ad hoc approach similar to FMEA; reproducible process to select LBEs for new reactors does not exist	Qualitative based engineering judgment	Not explicitly identified, addressed primarily using conservative assumptions based on engineering judgment.	No consensus standards as the LBE procedures do not exist; rests solely on regulatory review judgments.
Systematic RIPB	Incorporates approaches used in Ad hoc method in a systematic, reproducible PRA procedure.	FMEA, HAZOPs, MLD, PERT, PRA methods for systematic search for initiating events and defining accident sequences	Quantitative based on applicable service experience, engineering judgment and PRA data analysis methods	Explicitly identified and listed via structured PRA process,. Systematically analyzed and accounted for; defense-in-depth approach to capture uncertainties not well represented in PRA	ASME non-LWR PRA Standards, EPRI research, experience with HTGR and LMFR PRAs

Design Development Timeline

LBE evolution by design phase:



Inputs to design phases:

- Initial design concept
- Prior operating experience
- Expert insights

- Basic design
- Initial analyses (FMEA, scoping PRA, etc.)
- Prior operating experience
- Design rqmts.
- Expert reviews

- Updated design
- Detailed FMEAs, etc.
- Initial PRA results
- Expert reviews
- Regulator interaction

- Mature design
- Detailed FMEAs, etc.
- Complete PRA results
- Expert reviews
- Regulator feedback

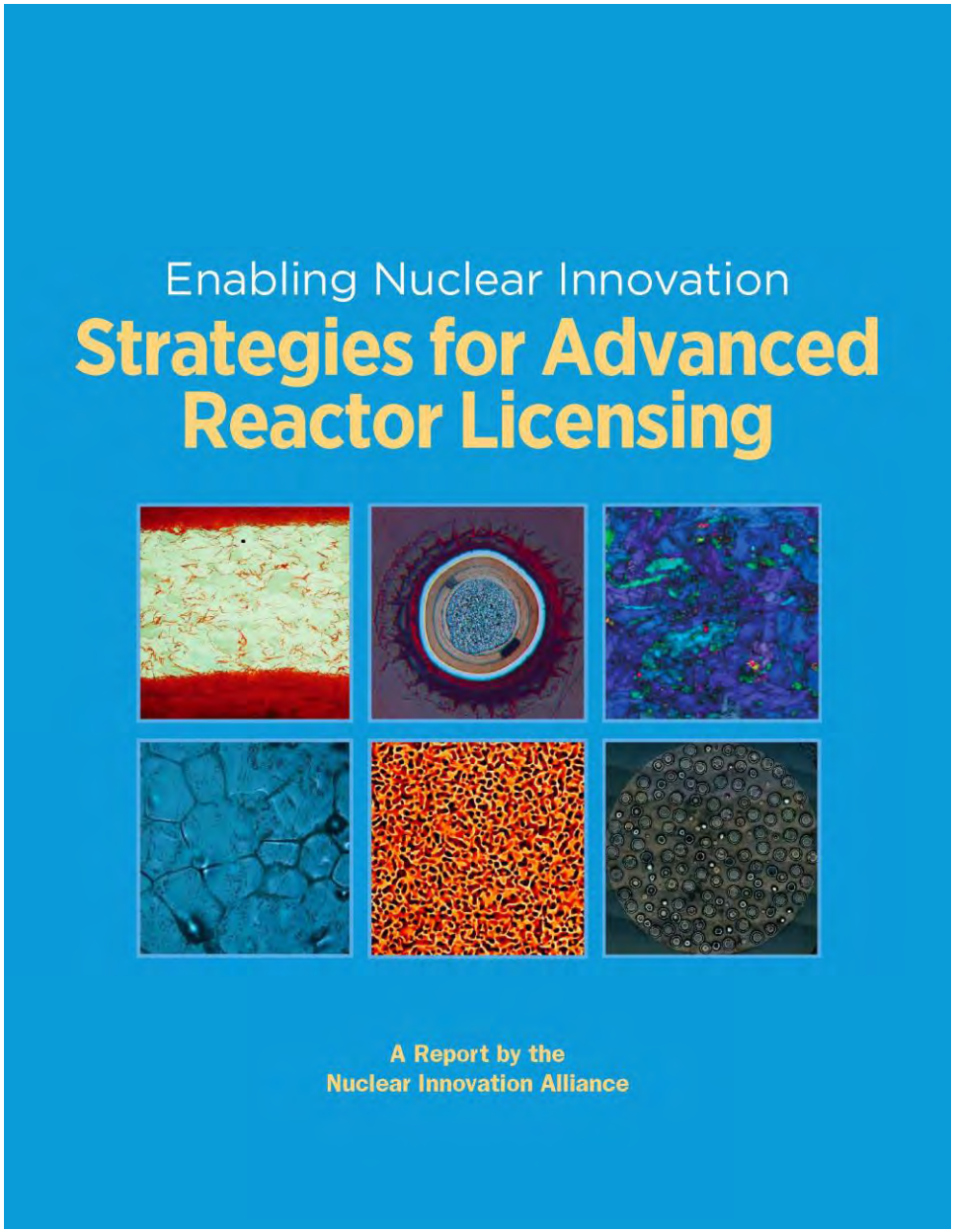
Comments on NRC Non-LWR Vision and Strategy Implementation Action Plans and Staged Licensing

Advisory Committee on Reactor Safeguards

Future Plant Designs Subcommittee

Peter Hastings

08 Mar 2017



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NRC Non-LWR Vision and Strategy

- Excellent foundation for non-LWR mission readiness
- NIA supports overall direction and most details
- Staged regulatory review should be further developed

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Near-Term IAPs

- NIA strongly supports each strategy
  - Acquisition/development of skills within NRC
  - Acquisition/development of computer codes
  - Development of flexible guidance
  - Support for industry codes and standards
  - Resolution of policy issues
  - Appropriate communication strategies
- Strategy 3 guidance should complete within two years
  - Collaborate with industry on detailed contributing activities
  - Accelerate efforts to support near-term guidance

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Near-Term IAPs (continued)

- Strategy 5 (policy issues) prioritized for near-term action
  - All work planned for FY2017
  - Coordination with industry
- Strategy 2 (computer codes) should be expanded
  - Enhance modeling and simulation for fuel qualification process
  - Should consider existing fuel information, e.g., within DOE complex
  - May require enhanced use of demonstration/prototype provisions

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Staged Licensing Reviews

- Staged regulatory review should be further developed
- Conceptual Design Assessment
  - Can provide more structure and certainty in pre-application interactions
  - Development in FY2017
- Standard Design Approval
  - Developing guidelines to define “major portion”
  - Coordination with NRC staff pending shortly
- Licensing Program Plan (Regulatory Engagement Plan)
  - Important communication tool
  - Establish applicant-staff agreement on path forward
    - Pre-application options
    - Application type
    - Project management expectations

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Conclusions

- NIA applauds and supports NRC efforts
- NIA eager to work with staff
  - Continued development of strategic and near-term planning
  - Various aspects of staged licensing
- Mid- and long-term IAPs under review

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