UNITED STATES

NUCLEAR REGULATORY COMMISSION

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PUBLIC BRIEFING ON

ADVANCED REACTORS AND NEW REACTOR TOPICS

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THURSDAY,

FEBRUARY 6, 2020

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ROCKVILLE, MARYLAND

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The Commission met in the Commissioners' Hearing Room at the Nuclear Regulatory Commission, One White Flint North, 11555 Rockville Pike, at 9:00 a.m., Kristine L. Svinicki, Chairman, presiding.

COMMISSION MEMBERS:

KRISTINE L. SVINICKI, Chairman

JEFF BARAN, Commissioner

ANNIE CAPUTO, Commissioner

DAVID A. WRIGHT, Commissioner

ALSO PRESENT:

ANNETTE VIETTI-COOK, Secretary of the Commission

MARIAN ZOBLER, General Counsel

NRC STAFF:

MARGARET DOANE, Executive Director for Operations

HO NIEH, Director, Office of Nuclear Reactor Regulation

MIKE KING, Director, Vogtle Project Office, NRR

JOHN SEGALA, Branch Chief, Advanced Reactor Policy Branch, Division of Advanced Reactors and Non-Power Production and Utilization Facilities, NRR

BEN BEASLEY, Branch Chief, Advanced Reactor Licensing Branch, Division of Advanced Reactors and Non-Power Production and Utilization Facilities, NRR

EXTERNAL STAKEHOLDER PANEL:

ALICE CAPONITI, Deputy Assistant Secretary, Office of Nuclear Fleet and Advanced Reactor Development, U.S. Department of Energy

DOUG TRUE, Chief Nuclear Officer and Senior Vice President, Nuclear Energy Institute

AMIR AFZALI, Policy and Licensing Director - Next Generation Reactors, Southern Company Services

EDWIN LYMAN, Director of Nuclear Power Safety, Union of Concerned Scientists

P R O C E E D I N G S

9:02 a.m.

CHAIRMAN SVINICKI: Well, good morning, everyone in the room and those who are listening in to our webcast, welcome. The Commission is convening this morning for a briefing on Advanced Reactors and New Reactor Topics, and I don't think we've met specifically on this for a little while.

We, of course, the Commission engages the NRC staff routinely on these topics and progress and status, but it was my sense that there just is a lot going on in this very dynamic area, and as I began to look into some of the background material, I found that validated to be a very true observation about it.

So, we will hear from two panels in today's meeting. The first panel will be invited external stakeholders. We will have a very brief break, and then we will reconvene and hear from the NRC staff on the same topics, but before we begin, do any of my colleagues want to -- think they feel the same as me? There's lots to talk about, so we all want to dive right in.

So, again, we will begin with the panel that is seated in front of me right now, and my intention is to recognize you simply in the order of the published scheduling note, which I think is also the order that you are seated here at the table.

So, I will begin recognizing and requesting the remarks of Ms. Alice Caponiti, who is the Deputy Assistant Secretary within the Office of Nuclear Energy, I believe, the Office of Nuclear Fleet and Advanced Reactor Development within the Office of Nuclear Energy at the U.S. Department of Energy. Ms. Caponiti, please proceed.

MS. CAPONITI: Thank you, good morning. I appreciate this opportunity to share my perspectives on licensing modernization efforts and the importance of these initiatives

for the deployment of advanced reactors in the United States.

An important part of our mission at the Office of Nuclear Energy is to accelerate commercialization of innovative nuclear technologies. A key element of this mission includes conducting the research and development to support the technical basis for effective regulation of these modern technologies.

Our strategy is focused on areas such as identifying and resolving regulatory uncertainties, identifying potential changes to the regulatory framework that would enable innovative solutions without compromising safety or security, providing technical support to the regulatory adoption of innovative approaches toward achieving safety, and funding priority research to generate the necessary technical information to support advanced reactor licensing.

As part of our overall strategy, we work collaboratively with the NRC and industry to develop technology inclusive regulatory strategies and processes. Okay, if you proceed to the next slide? Thank you.

DOE is fully supportive of NRC's efforts toward development of a risk-informed, performance-based licensing approach. We believe these technology-inclusive methods will address the most significant sources of regulatory uncertainty for the broadest range of stakeholders and will enable timely development of innovative solutions in a consistent manner.

Application of a risk-informed, performance-based approach assists industry stakeholders and DOE in identifying advanced technology vulnerabilities and uncertainties, helping to focus research efforts in the most impactful areas.

The foundational work resulting from the Licensing Modernization Project that Amir Afzali will be describing in greater detail this morning is documented in Nuclear Energy Institute's publication NEI 18-04.

We look forward to the next steps in implementing this approach, and we support the NRC staff recommendation provided via SECY-19-0117 to endorse NEI 18-04.

DOE has supported the risk-informed, performance-based processes for the licensing of advanced plants with efforts that date back to the 1980s, and you'll see a number of those efforts listed here.

The good practices feedback by the ACRS in its 2019 review of the industry and NRC staff proposals was a key endorsement of the Licensing Modernization Project approach.

The resulting focus on risk-informed, performance-based methodologies highlights the importance of establishing and maintaining strong partnerships between the private sector and government.

Going forward, DOE sees a number of important steps to bring risk-informed, performance-based methods into practice. DOE advanced reactor development projects like the Versatile Test Reactor will implement the approach developed as part of the Licensing Modernization Project.

Ongoing projects such as the Technology Informed Content of Applications Project or TICAP continue to mature this approach. These efforts promote advanced reactor regulatory efficiency by assisting industry in developing a common and consistent approach to NRC application development.

DOE is communicating the details and potential benefits of the approach through its collaborations with the international community, such as initiatives through the Generation IV International Forum and the IAEA.

DOE appreciates its ongoing coordination with NRC to help ensure that our

research and development priorities are supporting the most important regulatory information needs.

NRC has provided valuable feedback on joint industry DOE cost-shared activities focused on licensing modernization, including its interactions with the Nuclear Energy Institute Advanced Reactor Working Group and technology specific technical working groups. We look forward to continued progress in incorporating the outputs of these efforts into the regulatory process.

And I quickly wanted to highlight a number of efforts that support advanced reactor deployment, development and deployment broadly with the Office of Nuclear Energy.

DOE's Advanced Reactor Technologies Program addresses the technical, regulatory, and economic challenges for molten salt reactors, high temperature gas reactors, medical fast reactors, and micro reactors.

Our Versatile Test Reactor Project or VTR will provide a fast spectrum test reactor to speed up the testing of advanced technologies needed by new designs and our existing fleet, and as I mentioned, DOE intends to employ a risk-informed, performance-based approach to the design of the VTR.

The Advanced Reactor Demonstration Program is a major new effort funded with fiscal year 2020 appropriation to demonstrate multiple advanced reactor designs.

This program includes several important elements, including the National Reactor Innovation Center led by Idaho National Laboratory to support demonstrations, testing, and performance assessment of new technologies to accelerate commercial deployment of advanced reactors.

There are advanced reactor demonstrations that will be competitively select

cost-shared awards for two demonstration reactors that can be operational within five to seven years.

The funding also provides for risk reduction for future demonstrations that will support two to five awards to address key technical challenges for concepts that were not selected for one of the two demonstrations.

A request for information from industry, for industry feedback for these demonstrations was released late yesterday to seek industry input on how these demonstration projects could best be executed.

The fiscal year 2020 appropriation also provides funding for up to two cost-shared awards that we are calling the ARC-20 awards that will progress the development of selected advanced reactor designs toward future demonstrations.

And we continue to support a range of cost-shared advanced reactor technology projects through the industry funding opportunity, so you can see there's a lot of interest and funding behind put behind moving advanced technologies toward commercialization. And so with that, thank you.

CHAIRMAN SVINICKI: Thank you very much, and again, we'll do questions of all presenters at the end. So, next, we will hear from Mr. Doug True, who is the Chief Nuclear Officer and Senior Vice President at the Nuclear Energy Institute. Doug, please proceed.

MR. TRUE: Thank you, and good morning. I'm going to step back a little bit in the beginning of my presentation to talk about the big picture of what's happening relating to new and advanced reactors, and then kind of return at the end to a discussion on the regulatory priorities, but I think it's important that we understand the changing landscape that's occurring around new and advanced reactors.

NEI thinks the NRC is going to play a key role in any serious activities the U.S. undertakes to aggressively reduce carbon emissions, which is a major point of discussion in the States and nationally.

And while it's not the NRC's role to advocate for nuclear power, these changing conversations and the policy making related to carbon reductions increasingly place nuclear as a key component of any realistic strategy to address carbon.

This changing landscape is probably best exemplified by one of the things that Alice just talked about, a $230 million award for the demonstration of new and advanced nuclear, including SMRs, in the 2020 budget, a bipartisan accomplishment in a legislative period where bipartisanship is very difficult to find. Next slide, please.

This slide was taken from a press article last year, about the middle of last year, and it depicts the decarbonization trajectory of a number of U.S. utilities. It's not up to date. There have been many other commitments even since this, but the main picture you get from this chart is that everything is down and to the right.

This whole discussion about decarbonization and the realities of what it's going to take is not lost on utilities. We've seen, even last week, Arizona Public Service announced that they were going to go to zero emissions by 2045, and that continues to roll out across the country.

You may have also seen the press reports in the last few days about a report that Energy Northwest commissioned that focused on what it would take for Washington state to achieve their zero emission target that they legislatively mandated by 2045, and the main conclusion of that report is the most cost-effective way to get to that point is by using small modular reactors in the Pacific Northwest.

These utilities are the ones that run the grids, and they understand the realities of what it takes to deliver reliable power 24/7. Next slide, please.

If we kind of overlay that backdrop on a projection of where nuclear has been heading, this chart tries to bring a number of things to light.

So, the bottom part of the chart shows the current fleet, when the licenses run out, announced shutdowns that have been already made, and then adding onto that, the license renewal projects that are going on right now and we project into the future.

That shows a reduction in the current fleet over time. However, in order to run a sustainable, reliable grid that has zero or low carbon, there's a need for firm, dispatchable, carbon-free power to support that, and currently, nuclear contributes about 20 percent to that grid, and the grid demand, we expect to grow over the next 30 years.

So, the gap you see on the right, the 90 gigawatts is what it would take to make up the gap between the current level of only 20 percent nuclear to the demand of 2050.

Now, what utilities have been saying is that today, there is no way to operate a grid on 100 percent or even 80 percent renewables. Certainly, the renewable share is going to grow. Everybody expects that, but the need for the firm, dispatchable, carbon-free supply is very real.

You may have seen a recent article by MISO, the Midcontinent Independent System Operator, that said they don't believe they can get in their current configuration even to 50 percent renewables and sustain operation of their grid.

Some experts think you could probably get to 60 to 70 percent renewables, but the fact of the matter is that the wind doesn't always blow and the sun doesn't always shine, and there aren't storage capacities right now foreseeable that can support the kind of durations you

may need to support a renewable-based grid.

For example, California has been moving towards a zero carbon future, but in California, they went that 19-day period with no wind power. Batteries today can last a few hours, but making it to 19 days is a far cry from anything we see in the future.

So, as we move forward, we need that firm, dispatchable, carbon-free source, so the upper graph, upper line of that graph shows what it might take to get to two-thirds, and that's another 90 gigawatts.

Those numbers are sort of staggering, and even if nuclear doesn't achieve even those numbers, there's still a need to fill in that gap for the firm, dispatchable, carbon-free supply.

The last thing I want to point out is that this is EIA's projection of electricity demand and it doesn't account for other decarbonization efforts, for example, the electrification of the transportation sector. Onto the next slide, please.

So, what's 2050 and all of that got to do with today? Well, it has a lot to do with today. The achievement of these goals isn't going to happen overnight.

The decisions are being made now. Discussions are being had on what that future looks like, and we knew the renewable share is going to grow, but it's limited, even with storage as I just described.

Firm, dispatchable power is needed, and utilities are making decisions about how do they transition from coal plants to other sources. Transitioning from coal to gas is sort of an obvious and logical decision. However, in a carbon-free future, a gas conversion can end up being a stranded asset for that utility.

So, there's an interest in a competitive, cost-competitive nuclear option. The way that can happen is by executing the demonstration plants that the government has just

funded, completing the Vogtle plant, getting the NuScale design licensed and moving forward, and getting those demonstration done, because the real decisions about what that picture is going to look like is based on not the first of a kind, or only of a kind design of a plant, but actually the Nth of a kind.

So, the challenge in front of us is to move this industry in a direction where we have multiple options multiply demonstrated in order to make good decisions going forward.

Now, this has all become real. I would say when I joined NEI about 18 months ago, this conversation wasn't really happening, but I can tell you the tenor of the conversation with our member utilities has completely changed.

So, getting through the completion of Vogtle, getting the NuScale design approved, and seeing these demonstrations move forward is not only a priority for the industry, but it's a priority for the country.

Finally, I'd be remiss if I didn't mention that this is actually an issue of national interest to the United States. Right now, Russia and China are going around the world selling reactors to countries that are new to nuclear. They're establishing 100-year relationships.

The U.S. needs to compete in those markets. We need the technology to offer that, and the world would benefit from an NRC-approved U.S. design that would be available to those countries. Next slide, please.

In terms of regulatory priorities, I'll briefly touch on these and ask you to follow up with questions if you'd like. It's an industry priority to see Vogtle 3 and 4 completed in a timely manner to demonstrate we can finish those plants and get them online. To date, things have gone well and we expect that to continue, but it is a priority.

Getting NuScale and the other Part 50 and 52 applications we see coming

through the NRC reviews is another priority as we move through 2020.

The framework for making a decision on advanced reactors that we're talking about, NEI 18-04, the technology inclusive approach, and getting a right-sized future for microreactors and advanced designs that are inherently safe is an important next priority, and finally, making sure we streamline these processes to get through them quickly.

We're pleased that NuScale has been on time, but three-and-a-half years isn't going to cut it at the pace that we need to move. Efficient environmental review is also needed.

The changes to NEPA are coming and there are probably some enhancements that can be made in that regard with respect to NRC processes. And with that, I'll finish and turn it back to the Commission.

CHAIRMAN SVINICKI: Thank you very much, Mr. True. Next, we will hear from Mr. Amir Afzali who is the Policy and Licensing Director of Next Generation Reactors for Southern Company Services. Please, proceed. Thank you.

MR. AFZALI: Good morning. Thank you for affording me the opportunity to talk to you about the Licensing Modernization Project. LMP was initiated to develop a risk-informed, performance-based regulatory foundation for modernizing requirements for non-light water reactors. The project has led to the generation of NEI 18-04 which the staff has proposed to be endorsed in SECY-19-0117.

In the next few slides, I will discuss why we have started this project, how we decided on the scope, and then discuss the consequence frequency curve. Finally, I will wrap up with sharing some insights from the tabletop exercises that have been performed. Slide two, please.

The LMP objective is to reduce regulatory uncertainty for both designers and

regulators to enable accelerated commercialization of advanced non-light water reactors while maintaining public safety and health.

The LMP team believes the effective approach for delivering the objective is through utilization of risk-informed, performance-based methodologies.

We also believe that such an approach is an important step towards achieving the Commission's long-held goal of advancing the application of risk insight in the realization and demonstration of nuclear safety.

To deliver the project's objective, the team focused on developing transparent, repeatable, and risk-informed, performance-based methodologies to decide on the following key foundations of design safety, selection of licensing basis events.

The current regulatory guidance does not include a method for identifying LBEs for non-light water reactors. Such events include anticipated operation occurrences, design basis events, and beyond design basis events.

These events which form the foundation of a design safety case will be different for each design based on the underlying technology and design-specific features. Therefore, developing the technology-inclusive method for the LBE selection is expected to result in a significant reduction in regulatory uncertainty.

Classification of structures, systems and components, based on the lessons learned from the application of risk-informed, performance-based method for SSC categorization for the light water reactors, it was judged that a comparable process for SSC classification at the original licensing stage will be beneficial for both regulators and the future licensees.

The defense-in-depth adequacy determination, again, based on the lessons learned from the previous licensing activities, we have decided that the method which provides

clarity and transparency in the determination of defense-in-depth's adequacy is vital. Therefore, this foundational element was also added to the project scope.

Due to time limitation and the importance of LBE selection, I will concentrate the rest of my presentation on that particular topic. Slide three, please.

The LMP methodology is premised on the frequency consequence chart that underpins the systematic evaluation of LBEs in the context of appropriate individual LBEs and total risk targets. Targets are based on the interpretation of the NRC's regulatory requirements and the Commission's safety goal policy.

One of the most unique and insightful features of the methodology is a clear demonstration of the design margins for a particular design. These margins are exhibited through the gaps within each LBE's associated frequency and consequence for a design, and the frequency of consequence targets.

To confirm the practicality of the methodology, the following developers and organizations exercised portions of the methodology, X-energy for Xe-100, a high-temperature, gas-cooled, pebble bed TRISO fuel reactor design; General Electric Hitachi for PRISM, a sodium-cooled, metallic-fueled reactor design; Kairos, a molten salt core, pebble bed TRISO fuel design; Westinghouse Electric for eVinci, a heat pipe cooled, solid metallic fuel microreactor design; and EPRI Vanderbilt University for the Molten Salt Reactor Experiment, a molten salt cooled and molten salt fuel reactor design.

These slides present the results of some of these exercises, as well as previous results for a prototype modular high temperature gas-cooled reactor. Please note the anticipated margins to the regulatory targets for these designs.

A couple of key insights from these exercises are offered in the next slide. For

now, I would like to highlight that each point, each point on that frequency consequence curve is the result of a careful evaluation of the potential class of hazards that could challenge the safety performance of the design, the design's capability to respond to those challenges, and performance requirements of these plants' capabilities to provide reasonable assurance of success. Next slide, please.

The following are a couple of key insights from the tabletop exercises. The LMP process can be effectively executed for a spectrum of different non-light water reactor concepts from large reactors to microreactors. This indicates the technology inclusive nature of the proposal.

Design decisions can be optimized through an integrated and realistic analysis of plant response. This is important for maximizing safety while reducing unnecessary burden.

In addition to these direct observations and based on our experience in the use of risk-informed performance regulation for the current fleet, we have concluded that the knowledge gained through the LMP-based design evaluation will be used for building an effective operational risk management program. Next slide, please.

In summary, the LMP methodology as presented in NEI 18-04 was developed based on over 20 years of industry interactions with the staff on risk-informed regulation.

The insights from a number of industry tabletop exercises covering different technologies and designs demonstrate that the methodology can be effectively executed for a spectrum of different non-light water reactor concepts.

We are also reassured by the fact that the ACRS letter on Draft Guide 1353 finds that the methodology is reasonable.

The design next steps were enabling timely and effective deployment of the

LMP methodology, including defining critical and valuable actions. The Commission agrees with the staff position as documented in SECY-19-0117 that the NEI 18-04 methodology is reasonable and appropriate.

We believe that such an endorsement is a critical step in enabling the Commission's longstanding effort to transition to risk-informed, performance-based regulation, and it's key to achieving modern risk-informed regulation as envisioned in the agency's transformation initiative.

NRC endorsement of ASME non-light water reactor PRA standard also will be highly valuable. We believe this endorsement will reduce the NRC's review time, as well as reducing uncertainty.

Thank you again for allowing me to discuss this important industry initiative on behalf of the LMP team before you. Thank you.

CHAIRMAN SVINICKI: Thank you very much, and our next presentation will come from Dr. Ed Lyman, who is currently the Director of Nuclear Power Safety for the Union of Concerned Scientists. Ed, thank you for joining us again today. Please proceed.

DR. LYMAN: Yes, good morning, and thanks. On behalf of UCS, we appreciate the opportunity to talk to you again about these important issues.

I did speak to the Commission two years ago when you had a meeting on advanced reactors. I look back at that presentation, and I don't like to repeat myself or to bore anyone, but I would say that I still stand by the remarks I made then, so you might want to take a look at those again, but I will focus on certain emerging issues that I think are quite relevant.

So, you'll see that the first few slides I have, and may I have the next slide, please, refer to how an advanced reactor is going to be defined at the NRC.

And the reason why I focus on this is because we are trying to combat the misleading narrative by many of the vendors that anything labeled an advanced reactor is necessarily going to be safer and more secure than the current population of light water reactors, and therefore deserves the full risk-informed, performance-based treatment that is being developed now at the agency.

And we think this is problematic because there is no such animal as an advanced reactor that is necessarily going to be safer a priori. That's a determination we think the Commission should make.

And just looking at the range of proposed rulemakings, guidance, and other documents the Commission is preparing leads to confusion, at least to me.

And just looking at -- and not only to me, but even in the draft regulatory basis for the rulemaking on physical security for advanced reactors, I'd point out that itself acknowledges that the phrase advanced reactors has different meanings in different documents. I think that's a problem and I'll explain why.

Just looking at how that regulatory basis defines it, light water SMRs and non-light water reactors would be applicable to that draft rule. Well, that doesn't exclude a large CANDU. I don't think it's the intention that the Commission would apply that rule to a large CANDU application, but it's not excluded right now.

If you look at the revised advanced reactor policy statement from 2008, you can read that as saying anything other than a large light water reactor licensed before 1997 would be constituted an advanced reactor, and that could include the AP1000.

In any event, these are not functional definitions in that they don't embrace the expectations of the Commission's advanced reactor policy statement. In fact, the Commission

does not require that an advanced reactor actually be safer than the current population of reactors. Next slide, please.

This is further complicated by the NEIMA, the Nuclear Energy Innovation and Modernization Act, which itself defines advanced reactor, and therefore mandates the NRC implement certain new rules and guidance related to advanced reactors, but their definition is a functional definition in that an advanced reactor is something that has to have significant improvements compared to commercial nuclear reactors under construction as of January 14, 2019.

So, therefore, anything beyond the AP1000 that has significant improvements would be qualified as an advanced reactor, and they list a whole range of characteristics, but they're not clear about how many of those constitute a significant improvement.

And even more problematic is what if you have reactor designs that have improvements in one or more of those areas, but are actually deficient or disadvantageous compared to light water reactors in the others? And I would say most, if not all, non-light water reactors have such disadvantages. Next slide, please.

So, the NRC's obligations under NEIMA are all qualified by "where appropriate." So, the strategies for increased use of risk-informed, performance-based licensing evaluation techniques and guidance are to be applied only where appropriate, and I highlight that because UCS did not oppose NEIMA.

We took a neutral position largely because we thought that provision gave the NRC full discretion to decide when to apply these requirements, but again, under NEIMA's guidance, that would mean those with significant improvements compared to the AP1000, and it does not specify how the NRC should decide what an advanced reactor is or how it should rate

those criteria. Next slide, please.

So, my large overarching concern with the risk-informed, performance-based methodology is that I think there's too much dependence on the probabilistic risk assessment and making essentially a common cause failure mode in the approval of these reactor designs.

As I've said before, for a non-light water design that's still on a paper, these are really academic exercises and they don't have sufficient data for validation certainly at this stage.

And the problem is that that PRA, along with the mechanistic source term, which is another key aspect of doing a level three analysis to estimate health and safety consequences, that those instruments would be used to justify, looking at all of the various things going on at the NRC, siting reactors in densely populated urban areas, elimination of off-site radiological emergency planning, reducing the number of armed responders below the current minimum, reducing the number of qualified operators below the current minimum, allowing no containment structure in compliance with the general design criteria, allowing no safety-related electrical power, and allowing a broad reduction in NRC oversight once you get to the inspection stage.

So, I'm confused about what the cumulative impact of all of these regulatory rollbacks are, but they do have in common, they all go back to the original licensing basis events and their frequencies, and I think that's a problem.

Another problem is that the current methodology does not include the potential for enhanced probability of rare events due to sabotage that I think another look needs to be taken at that because events that may be qualified as beyond design basis in the new methodology and therefore screened out for a variety of different applications may not be rare if you consider sabotage attacks.

One example would be multi-module releases. If you have a sabotage attack,

you can imagine that a rare multi-module event that may have been screened out would actually not be so rare and could impact off-site consequences, so I think that needs to be looked at. Next slide, please.

So, to sum up that discussion, and one other problem is it's not just the methodology within the application, but it's also the nature of the application itself.

So, we've heard, well, advanced reactors that are safer don't need as much review. They don't need as much detail on the application. You can risk inform the information that the NRC gets in reviews, and that, I think, can lead to circular reasoning because if you assume from the beginning that you don't need to see certain information, you don't need to probe through requests for additional information to get to the bottom of certain uncertainties, you may miss things and that could lead to a feedback loop which would have negative consequences.

So, we think there has to be stringent criteria. If a reactor vendor comes in and wants to use these risk-informed, performance-based methods for advanced reactors, they have to justify to the Commission's satisfaction that there's a good chance they will meet certain safety and security criteria before allowing them to use these new instruments. Next slide, please.

One issue in particular we're very concerned about is changing the policy on urban siting, in fact, revising guidance to remove the current prohibition against siting nuclear reactors in densely populated urban areas.

There's a long history to that, but my review of the staff's proposal does not think it's adequate, and in fact, we don't think that provision should be changed without additional criteria for siting, including some sort of societal risk measure.

And as I point out, I love this quote by Commissioner Bernthal back in the Safety Goal Policy Statement, "You can put a nuclear reactor in the middle of Central Park and possibly

meet individual dose limits, but of course, the consequence of a large release of cesium on the surrounding environment would definitely discriminate between siting that reactor in the middle of New York City and putting it in a remote area."

So, without having that kind of society consequence measure, I feel changing that policy will not adequately address the increased risk of such siting. Next slide, please.

Sorry, I'm running out time, but I just want to give one example of an advanced reactor, why not every advanced reactor is a safer reactor. And the molten salt reactor which has a liquid field molten salt reactor is essentially a fission product release mechanism.

Noble gases are continuously released by design from the core, and that leads to problems not only for health and safety, but also as I point out, for potential verification of the Comprehensive Nuclear Test Ban Treaty, which could be a severe problem for nonproliferation in the future. Next slide, please.

And I provide some results a study that was done looking only at the current, the largest releases of radioactive xenon in the world are the handful of medical isotope reduction facilities around the world, and even those are causing problems with the verification system for the Comprehensive Test Ban Treaty, in other words, being able to detect a signature of a nuclear test explosion and discriminating that from the background caused by xenon. Next slide, please. And go to the next one, and I'll just -- next slide, please.

And just finishing up, I did a recent study where I found that a typical molten salt reactor such a single terrestrial energy unit 400 megawatts thermal would emit many orders of magnitude more xenon-133 than is even released by the medical isotope reduction facilities, which themselves are causing problems today with verification.

And this is an issue that I think the Commission is going to have to deal with, in

other words, imposing strict limits on xenon emissions in order to make sure they are not, these reactors are not inimical to the common defense and security by compromising this very important treaty verification.

And I'll stop there, and I apologize for exceeding my time. Thank you.

CHAIRMAN SVINICKI: Thank you very much, Dr. Lyman, and again, my thanks to all the members of the panel. Consistent with our Commission's practice, we will rotate the order of questioning today, and we begin with Commissioner Baran.

COMMISSIONER BARAN: Well, thank you all for being here and for your presentations. I'd like to ask some questions about the Licensing Modernization Project and a risk-informed approach to establishing key parts of the licensing basis for non-light water reactors.

Because this would involve a probabilistic approach to identifying licensing basis events, classifying structure systems and components, and assessing the adequacy of defense-in-depth, a designed PRA would be of central importance.

Some of these designs might never have been built before. Unlike light water reactors that have been operating for decades, there may be no operating experience to rely on in developing the PRA.

How would a vendor or NRC validate the PRA for a first-of-a-kind non-light water reactor? I'm looking at you because you presented on this, but anyone can, you know, feel free to share their thoughts.

MR. AFZALI: So, thanks a lot for that question. That's a question we are often asked, and the simplest answer is there is a non-light water reactor PRA standard which provides the basis for developing data for a situation where you do not have adequate operating experience.

And fundamentally, that's the strength of the PRA, to operate in an environment where you do not have a lot of data, the rare events. That's a strength because it provides a tool for deciding on uncertainties, to seeing the margins. It provides all of the information.

The decision, the PRA doesn't make a decision, the PRA risk assessment tool. The decision is made through a risk-informed decisionmaking group, that process, and that process results in having additional information.

Having quantifiable information and having information on uncertainty will allow you to make better conservative decisions.

COMMISSIONER BARAN: Doug, did you want to add something?

MR. TRUE: Yeah, just to add a little bit to what Amir was saying, I agree with everything he said, but if you go back to the original light water licensing, we allowed people to make judgments about what would be picked and how it would be approached.

What PRA provides is a systematic way to go through a design and identify what could be important, and identify where we know we are fairly certain about things and where we're uncertain.

And the PRA process, and the standard that goes with it, and the LMP process allows you to illuminate those uncertainties so that you can focus in on the areas where you don't have good knowledge rather than just relying on a decision outside of any context to pick this or that or the other, so it actually provides a better framework, a more holistic framework in identifying that.

And we've seen that in our operating experience with LWRs. The deterministic basis completely missed station blackout and we had to go back, and it wasn't until we did PRA that we said, "Oh, we missed that," and so we had to go back and modify our regulatory framework

to fill that hole in.

So, by bringing PRA up front to help get the whole fabric, overlaying a consideration of defense-in-depth and safety margins as the LMP process does, you actually get a better fabric to build the whole entire licensing basis on.

COMMISSIONER BARAN: Any other thoughts on that?

DR. LYMAN: Yeah, if I may, yes, I agree that we think it's problematic for a reactor that hasn't had even a small scale demonstration yet to put so much reliance on the PRA.

And, yes, in theory, the methodology would address uncertainties through the defense-in-depth mechanism, but my concern is that the uncertainties are not going to be treated with enough weight and the defense-in-depth is not going to be adequate, and in fact, the uncertainties may be so large in these models that actually they would not be useful in doing this kind of discrimination.

Just looking at the chart that Amir put up, I don't see the error bars on these results, and I think that would be at least helpful for establishing where the errors are today, so we think a more systematic approach would be related to prototypes.

I know the Commission has a kind of ambiguous position on prototypes, but we think that if Nth of the kind reactors are going to be licensed using this approach, there should be at least a prototype to validate some operating information and reliability data for some period of time, and that prototype should be licensed with additional safety features to compensate for those uncertainties. Over time, that data could allow perhaps a transition to lower margins.

COMMISSIONER BARAN: I'm trying to think through how this overall process would work in real life. I'm assuming that, at a high level I'm talking about here, a vendor would design the reactor, then develop the PRA, and then use the PRA and the LMP guidance to

establish the licensing basis for the reactor.

How mature is the design when it's time to develop the PRA, and how mature is the PRA when it's time to apply it to developing the licensing basis? It's kind of a conceptual question, but --

MR. AFZALI: Very good question actually. A lot of developers ask the same question because when you come to the NRC, typically it's at the end. You come in and this is the final kind of whatever stage the design is of what a decision is being made.

So, it's not really -- I would say most of the time, we get that question asked by the developers. When do I introduce it? So, our process is flexible to introduce the PRA the way you described with what you call to confirm your design, or you can integrate that part of the design process where you start with kind of a design, then you do a PRA to see where vulnerabilities are and keep improving, and at the end, you decide on your licensing basis events because it's a selection process. It's not at the beginning you said this is it. You're selecting between different designs and what system you want to credit.

So, it's a very good question. We have developed guidance on how to do it. There are a few white papers that DOE has sponsored for us to develop, so there is a process to do so.

COMMISSIONER BARAN: Did you have anything?

MR. TRUE: No, it's an evolutionary process. You start with a design and concept that's, you know, pretty high level.

You can get a sense for where the risks are from that, but then as you go through that process, you have to spend more and more time analyzing that to develop a good technical basis for that selection.

DR. LYMAN: If I could just offer, Ms. Caponiti did say that the Versatile Test Reactor Project was being designed and licensed in DOE space using a parallel method, that their definitions are somewhat different.

But there were presentations about that at the recent American Nuclear Society meeting where there were some issues that came up in how that process was being applied, and some of them did have to do with the fact that the designers are not necessarily well versed in PRA, and that there was some communication issues in trying to establish a common language even, so you might want to seek or get some briefing from them at some point.

COMMISSIONER BARAN: Ed raises the question about the degree to which the licensing basis of a reactor would depend on the PRA, and it sounds like he's concerned that essentially there's a risk of common cause failure as he termed it because if a PRA turns out to be flawed, then all of these vital elements of the licensing basis in NRC review are probably going to be flawed too if I understand his argument. How would others respond to that concern?

MR. TRUE: I'll go back to the station blackout example. The deterministic process has the same potential problem. So, you can set deterministic rules. You can layout requirements and allow and provide defense-in-depth, but at the end of the day, until you have that integrated view that the risk assessment provides, you don't actually see how all of that fits together.

So, the LMP process sort of starts with the PRA and then overlays the defense-in-depth and margins. You can do it the other way, but at the end of the day, you need both perspectives. That's why it's risk informed. It's not risk based.

COMMISSIONER BARAN: Ed, are you satisfied with that response? Does that convince you or would you have further thoughts on that?

DR. LYMAN: Again, I think if you look at the scope of what's being proposed to be relied on in this initial analysis, you know, certainly, yes, there are insights that you get from risk assessment. It wasn't just station blackout, but also WASH-1400 predicted the small break loss of coolant accident, right, but that isn't the entire story.

And you might also argue, well, yes, if station blackout was identified as a risk outlier, but it was not sufficiently addressed because of a misunderstanding of the likelihood and the extent of station blackout as we saw at Fukushima, so it cuts both ways if you use that example.

MR. TRUE: Well, it does if PRA were used or had even been considered in the Japanese reactors. There was evidence. I think Commissioner Apostolakis made this clear back during in the post-Fukushima era that if there was evidence that they had used a risk-informed view, they would have understood the risk associated with the tsunami.

And if you look at the plants today, I was just at the Hamaoka plant back in the fall. They have a 25-meter tall tsunami wall, I mean, as opposed to a 10-meter hill of sand that they had had previously.

So, I think it's clear, the understanding if they had taken a look at that in more detail probabilistically, they would have ended up with some understanding of that risk, and they didn't, and so it's not right to blame PRA for missing that when they never even applied the concept to what they were doing.

DR. LYMAN: May I, and I'd say there are --

(Simultaneous speaking.)

DR. LYMAN: I'd say there are U.S. plants, yeah, we know where there are potentially similar external risks that the NRC has not, let's say, dealt with in a way that we'd

consider adequate.

COMMISSIONER BARAN: Thank you. Thanks.

CHAIRMAN SVINICKI: You know, the sign of successfully engaging a panel is if you can get that kind of evolution and a dialogue.

(Laughter.)

CHAIRMAN SVINICKI: No, no, it is. No, it was very, very interesting, but thank you for respecting the time of your colleagues because Commission Caputo was patiently waiting. Please proceed.

COMMISSIONER CAPUTO: Thank you. Well, clearly there is a lot of interest in this topic given the attendance in the room, so thank you all for making the time to be here and present. I definitely appreciate the time and dedication to this issue and your willingness to be here.

So, one of the observations that I had in preparing for today was that there's clearly a sense of urgency on the part of a lot of significant external stakeholders.

Between Congress passing multiple pieces of legislation, NEIMA and NEICA just to name two, the appropriations that Congress has given DOE to pursue a range of projects, and the work that the industry is doing both on its own and in partnership with DOE, there is clearly a sense of urgency and an effort to lay the groundwork for licensing advanced technologies.

I just want to say that I recognize that and I share that sense of urgency. I also recognize the cautionary notes offered by Dr. Lyman because clearly we need to move forward in a thoughtful approach, a thoughtful, very safety-focused approach, which I appreciate the discussion back and forth this morning on PRA and risk informing.

I do feel like risk-informed, performance-based gives us a very thoughtful and

thorough approach, so that is very much where I will probably apply my focus as a Commissioner going forward beyond this meeting.

So, let me start with one question. A lot of the debate so far over PRA and risk informing left out the performance-based. Would anyone like to sort of offer up how that approach can also compensate perhaps for uncertainties that we find in risk-informed?

MR. AFZALI: Sure, thanks a lot for the question again. That's perhaps one of the areas which is often missed in this conversation of risk-informed.

The maintenance rule example of where performance-based approaches have helped quite a bit the operating fleet to understand how the equipment are expected to perform and what level of reliability they should have, availability and reliability.

I would say that's exactly the concept you're applying in the LMP, where as part of the evaluation of the sequences, we look at the success paths. The current PRAs, they look at the failure paths only.

In the LMP process, you look at the success paths and why are they successful, and you set the performance based on that success path, so having that performance availability, it allows you to look at the programmatic approaches to make sure that what you assumed is correct.

So, monitoring and inspections commiserate with the importance of the components and indicative of its assumed performance, so that's the performance part, a very important part, and thank you very much. I should have said something and I didn't, and I appreciate the question.

COMMISSIONER CAPUTO: Alice, anything to add?

MS. CAPONITI: I don't, but I did want to come back to a former point, and you

had mentioned NEICA. One of the important elements of NEICA was the MOU that we entered into with the NRC, and so, as well as the MOU that we're entering into with the Versatile Test Reactor.

So, the Department of Energy fully intends to use opportunities where we're supporting early demonstrations of advanced technologies to provide opportunities to work with these processes and new technologies to help inform a strong regulatory basis, and I did want to point out the importance of both of those efforts that we see with this legislation.

MR. TRUE: Maybe I will. I want to go back to kind of combine two things that Amir said in his talking points.

This transparency aspect of LMP is important because it lays all of this out and it ties to the performance-based because by understanding explicitly what performance you need in order to address the success you need to see and the uncertainties you see in one framework.

It gives you a much clearer picture of what the safety picture of the plant is that we lose in kind of the deterministic, piecemeal requirement here or requirement there overlaid on top of each other.

So, I think the point you're raising on performance-based is a good one because they all connect that way into a clearer picture.

COMMISSIONER CAPUTO: I think one of the things that I like about that process is that it can be very transparent, that it can be very quantitative, but I think that leads to a team effort and a variety of perspectives being offered that can scrub the numbers, point out differences of opinion, differences in calculations, and at the end of the day, really lead to a more thorough product, so I like the transparency aspect of that process. Dr. Lyman?

DR. LYMAN: Yeah, if I could just, so, to my mind, performance-based rules

require performance demonstrations to validate them, so that's another reason why I don't think, if we're talking about licensing a first-of-the-kind reactor, that performance-based is necessarily appropriate because you're going to be demonstrating performance only after the reactor is built.

So, the other aspect of performance-based is if you make the requirements too high level, it can make it difficult for the Commission to inspect and the inspectable areas become perhaps too vague, and maybe it will be too much leeway in getting to that consequence and that will introduce uncertainties.

So, performance-based, I don't really see that as something that's useful in the initial design and licensing of first-of-a-kind reactors.

COMMISSIONER CAPUTO: Mr. True, NEI issued a report on microreactors in November, and I understand our staff is assessing whether the paper raises any policy issues that might require a Commission decision, but in the interests of time, since you're here before us today, can you give us your perspective on whether or not you think there are policy issues that are raised?

Because obviously, we have a microreactor that's on the verge of filing an application, so in the interests of expeditiousness, can you just give us your perspective?

MR. TRUE: Yeah, I think there well could be. I mean, I think the staff is going to have to go through their systematic review in order to determine that.

But microreactors are fundamentally far different than the traditional large light water reactors that we look at today, much closer to maybe a test reactor type of reactor in terms of source term and power levels.

But some of the things we identified in our paper, including security requirements, local operations, NRC resident inspectors, those are all things that are kind of

moving into the current regulatory fabric that are going to have to be revisited for a power producing reactor like of a size of a microreactor, so I think it's likely there could be some things that come up to you.

COMMISSIONER CAPUTO: Okay, thank you. I think I have one last question. Dr. Lyman had a slide which was kind of scary. It shows the world sort of awash in xenon.

I'm kind of curious about that issue. I noticed xenon-133 has a five-day half-life, so how easily is this manageable in some sort of a design?

MR. TRUE: I'm not prepared to respond to the data that Dr. Lyman presented.

COMMISSIONER CAPUTO: Amir, have you folks anticipated this issue yet?

MR. AFZALI: I'm in the same position as Mr. True. I think that designers are well aware of their limitations and the challenges, and they adequately address them, but I'm not prepared to talk about what designers think. I apologize.

COMMISSIONER CAPUTO: Okay, thank you.

CHAIRMAN SVINICKI: Thank you very much. Next we will hear from Commissioner Wright. Please proceed. Thank you.

COMMISSIONER WRIGHT: Good morning. Thank you. This has been very interesting so far. And I really like the dialog that's going on that side of the table. It's kind of cool.

So, Ms. Alice, your slide that you showed that -- on DOE's current and planned deployment efforts under the FY2020 Appropriations Bill, you can -- I understand it's $230 million to start some, the demonstration program for advanced reactors.

And that includes $160 million to build two reactors for -- that can be operational

within the next five to seven years I understand.

So, you're going to leverage all that with -- was that with Idaho National Labs? Or where is that going to happen at?

And I guess, with all this on the horizon to get to the question I'd like to have you answer is, is what opportunities do you see, if any, and you started to expound a little bit on this, but what opportunities do you see, if any, for a collaboration with the NRC with these programs?

MS. CAPONITI: Yeah. For that large advanced reactor demonstration program, there are a number of elements. The $160 million to support two actual constructions of reactors within five to seven years to be operational, that's a key component.

In addition, $30 million to initiate risk reduction projects for those that were not selected for one of the two demonstrations.

In addition, there's a part of the budget that is focused on regulatory development. And this is an area for research and development with our national laboratories to focus on those research efforts that are most significant to support licensing and regulatory aspects of advanced reactors.

And additionally, for the first time, we have funded in our budget, a nuclear energy to support safeguards and security aspects you need to advance reactors.

And then finally, the National Reactor Innovation Center that's led by INL, is intended to be a resource to support advanced reactor demonstration activities broadly.

So, certainly INL can be a site to demonstrate one of these demonstrations. We expect that concepts could include demonstration sites other than INL. That's open. That will be part of what people put forward to bid.

But, the capabilities of the National Reactor Innovation Center are to provide expertise not only to developers and support demonstration, but also we intend to work closely with NRC to ensure that any expertise capabilities' access to data is available to NRC to support their regulatory needs for their confirmatory activities.

So, just to emphasize the importance of how we see these activities supporting NRC's needs, we met with NRC very early after the budget passed, to walk through all of the potential areas to support collaborative activities.

And to help us understand where NRC's priorities are in research and development, so that we can take that into how we prioritize our work.

COMMISSIONER WRIGHT: Let me -- regarding innovation, let's go there. So, I understand you've got, or planning on dedicating like $11 million to demonstrate the production hydrogen onsite at a nuclear power plant.

And I mean, obviously it has the opportunity to open up markets and do new things. Does DOE already have a site picked out for that? And I guess where you're willing to pilot it.

And will you be using demonstration program reactors for this?

MS. CAPONITI: So, for the hydrogen demonstration, that appears, I believe, under our light water reactor sustainability area. I'm just - - yes.

So, we recognize that for the existing fleet, and as will be important for advanced reactors, having economic products beyond electricity production is going to be important to address the economic posture of nuclear plants.

Our earliest activities with demonstrating hydrogen production as another economic product has been with the existing fleet.

So, the Office of Nuclear Energy has a current award to do a small scale demonstration of hydrogen production. As had EERE has a similar award to do a similar activity.

So, this funding for hydrogen production demonstration appears with the light water reactor system ability. And I expect that again, to be with plants in our existing fleet.

MR. TRUE: Yeah. There are four utilities that are pursuing this. It's really sort of using nuclear electricity to create hydrogen.

Different then for example, high temperature gas reactors that can be used to directly product hydrogen independent of electricity.

COMMISSIONER WRIGHT: Sure.

MR. TRUE: But, there are a handful of sites that are moving forward with this. And they see it as an opportunity.

When electricity prices may drop in the market, they can use their electricity then to make a product to help them in their flexible operations.

COMMISSIONER WRIGHT: Sure. Okay. Thank you. Dr. Lyman, I really appreciate hearing you talk about some things and the view that you bring.

I've got a question based on some of the things that you've raised. And maybe just to add some, I guess, some meat to it for me.

On your first slide you discuss that the NRC had not established a consistent definition of the term advanced reactor.

My understanding is the NRC is addressing various advanced reactor concepts through policy groups, and I mean, policy guidance, that's going to be consistent with the different technical aspects of reactor designs being developed.

Specifically, the Commission's policy statement outlines the minimum

expectations for advanced reactor designs. And it appears consistent with the definition of advanced reactors that was signed into law as part of NEICA.

And we've heard NEICA mentioned here a little bit earlier. I'm interested in better understanding what specific definition you have in mind that is not currently covered by the Commission's policy statement or NEICA.

That would encompass all the different types of designs.

DR. LYMAN: Yeah, just to clarify, I don't think in the -- I think NEICA and NEIMA both have the same definition of advanced reactor that is not consistent with the policy statement.

The policy statement says that advanced reactors should be, and I'm paraphrasing, at least as safe as the current generation of light water reactors.

And it has an expectation that advanced reactors should be safer. But that was never a requirement.

So, as I point out, the 2008 policy statement even the EPR where anything that's better than what was licensed, any light water reactor licensed in it was 1997 or something, you know, would possibly constitute an advanced reactor.

So, my issue -- so there are two different issues. One is, should every non-light water reactor be automatic -- or a priori qualified for various rule makings and guidance that are being proposed, like the physical security? Which specifically says, non-light water reactors.

I don't think that's a specific enough definition, because that allows a -- those applicants to enter into a process that a priori assumes that it will have safety, some safety benefits compared to the operating fleet.

And I'm just saying that assumption, I think, is not necessarily true. And that I

believe if the Commission should define advanced reactors as those that do have significant, a good argument other than a slogan or a, you know, that the reactor, there's a very good reason to believe that it will have safety and security benefits compared to the operating fleet.

And that they are worthy of this special access to these new regulatory processes. So, that's it.

COMMISSIONER WRIGHT: Okay. Thank you. I don't know that I really have anything that I could add. I appreciate the questions that we've had.

You've covered most everything. Mr. True, did you have anything?

MR. TRUE: Yeah, I was going to go back to the demonstrations, because you asked NRC how NRC might be involved.

That RFI just came out last night, I found out this morning. And so we don't exactly know.

But, we have been interacting with our members, both advanced reactor -- both reactor vendors, advanced SMR, new, however you want to term them, as well as utilities.

And there are a number of utilities who are actually interested in potentially seeing one of those demonstrations be in a power producing, electrical power producing demonstration.

So, you know, obviously DOE will go through their selection process. But, it wouldn't be surprising if one of those demonstrations triggered an NRC review.

COMMISSIONER WRIGHT: Very good. Thank you.

CHAIRMAN SVINICKI: Well, thank you all very much. I had been dreading it come to me, because as I listen to the presentations and then the very interesting questions of my colleagues, I have a set of things I'd love to hear from you on that are like, strange

philosophical things, because we've been talking about risk.

And that always takes my mind in that direction, risks in human beings, which is such an interesting -- and society, such an interesting thing to talk about.

But, there's also some transactional things that I want to cover. Maybe I'll start with that, because we are very grateful to have DOE here today. Such an important partner to us in all that we're doing.

And the NRC staff does its best to keep the Commission informed about kind of all what's going on right now in DOE space. And how they're participating, which is kind of really what others have asked about, and so important.

So, Ms. Caponiti, you're very busy, because you had a very long list of things that Congress is asking you to do. But, maybe I'll ask two things.

The first is your general characterization of kind of the sufficiency is NRC showing up and kind of participating or taking the role that they need to appropriately take? And maybe having input some of what's going on?

Is that happening at a, you know, at a level and depth that you think is sufficient? And I hear good things from our side that there's real meaningful participation and dialog going on.

The second thing is more specific to kind of codes and modeling and simulation, and things like that.

Now, when I go about, as my colleagues and I do, and occasionally talk to members of Congress, there seems to be this concern that NRC has this insistence on having its own computing tools and its own, you know, models and things like that.

Now, if I -- as our Commission has had meetings with the NRC staff, they say,

well, it is true that we have our own tools to look at the safety conclusions that we have to make.

But they're simplified. And they're useful for what we're doing. We don't need, we're not designing the reactor.

We're running to ground certain attributes of its integrated performance so that we can make the safety conclusions to license it.

But, that being said, there is a lot of work that the Congress has had DOE investing in. A lot of simulation tools. A lot of modeling tools.

And my sense is, NRC staff is participating to have knowledge and understanding, and things like that. I don't think they're willing to say, we don't want our tools anymore.

Which of course, the reason that Congress is interested, is those have to be invested in. They have to be maintained. So, there is a need for NRC to expend resources on there.

Is there anything from the DOE standpoint that you kind of, hearing that that's the state of my understanding of kind of the back and forth on this, what is maybe a DOE, some high level DOE thoughts on that topic?

MS. CAPONITI: Okay. So, to your first question, in terms of NRC participation. In addition to the examples that I provided in terms of the appreciation of NRC's participation in industry activities, whether it's the Nuclear Energy Institute’s Advanced Reactor Working Group and our Technology Specific Working Group, that has been important.

For me personally, in terms of managing research and development programs, and making sure that we're putting our efforts in the right areas that are important to industry and NRC, I have appreciated NRC's participation in meetings that we've had.

So, whether it's --

CHAIRMAN SVINICKI: You're being kind. Because of course we stole for our Office of Nuclear Regulatory Research, someone from DOE. That -- I'm hoping that's facilitated the engagement.

(Laughter)

MS. CAPONITI: That is true. And we are also benefitting from NRC people coming to the Department of Energy. So, we're sharing.

But, I will say, NRC's participation, whether it's research, NRR, they are coming to our meetings. They are taking the time to hear about the work that we're doing.

We can't convey in a one-hour meeting all of the work that's important. So, actually having their time at our meetings, our workshops, I think is important.

Because if we're doing good work, and it's useful to this organization, we want to make sure that they understand the complete breadth of work that can be taken advantage of.

We also talk routinely with NRC to understand, if we're going to be focusing on research, not only do we want new technologies to be developed that are important to industry, but really to get that payout for seeing something deployed, it needs to be licensable.

And so we take very seriously that we need to focus our research that addresses the regulatory end state, in addition to the innovation.

On the modeling and simulation tools that we're developing, we've had very strong, consistent communication with NRC. To make sure that the tools that we're developing are not only useful to industry, but can be useful to NRC.

And if industry is planning to use these tools with their engagement with NRC, we want to make sure that we're addressing NRC's insights and needs as we're doing that.

We have had NRC work with us as we work to make the supporting data available to under pin these tools. To ensure that as we're applying quality processes to legacy data, that it's a process that would be seen as acceptable to NRC.

And so all of these interactions have been important.

CHAIRMAN SVINICKI: Yes, and thank you for that. And thank you for mentioning the, you know, kind of reestablishing pedigree around legacy data.

I have asked about that in previous meetings of our Commission with DOE representatives here. And also asked advanced reactor designers and vendors about their participation in that.

So, I know that that is an important activity. And that that is still ongoing.

Well, thank you for your general characterization. You know, I have heard from, you know, a few NRC folks that in their observational experience, this is probably some of the best communication we've had between DOE and NRC on topics.

Now, partly it's an expression of, as Mr. True was mentioning, the strong external interest in advanced reactor technology. So, federal agencies tend to step smartly when Congress is super interested in something.

So, that's not, it's a little bit of cause and effect there. But, thank you for that again. And for the work that's going on.

And particularly since DOE's been funding in regulatory development, which on its face looks a little awkward. But, I think it's because you have the labs, you have the assets.

I mean, although we have a small research budget, we're really -- we don't bring the regulatory kind of broad capacity to these things, or the research broad capacity.

So, we need to kind of take our regulatory expertise and put it into infrastructure

and people, and research environments where it can be done.

So, well hopefully yeah, more progress to come on that. But, thank you for that characterization.

And since I teased out kind of a weird philosophical thing, now everybody's like, well I hope she leaves time for the weird philosophical thing that she wanted to get opinions on.

So, recently our Commission, it might have been our most recent meeting, was on nuclear medicine technologies. And it was not one of our innovation or transformation meetings which we do have intermittently.

This was really on that, but we had invited an external panelist to come from the Food and Drug Administration. Because of course that's a strong regulatory.

We have some touch points with the FDA on medical, nuclear medicine and medical devices. Which was really his expertise.

But it turns out, he was -- I think his title might have been Chief Innovation Officer for FDA. So, I don't really -- I'm not clear on how that happened, but maybe he should have been at an innovation meeting.

But in any event, they had really stepped back as a regulator. And looked at their time for the approval of medical devices.

And of course, they've gotten scrutiny. I'm sure we've all heard about it of, you know, people may have rather desperate health situations.

And you know, the standard of saying the longer it takes for something to be available to patients who might not have a lot of treatment courses that offer them much hope sadly, you know, you really need to think around this question of risk.

But they took something that I think was in excess of many years. And they

got it down to months. So, it was just on that raw statistic, it looked like it must have been a real sea change in their thinking.

So, one of my colleagues, not me, asked the question of this individual from FDA, they said, you know, can you talk about anything?

And was kind of stepping back and thinking about how you were treating risk, do you think that that was a contributor too completely revising your entire review process in this way?

And he said, well, we have a transcript, but I'll paraphrase. Something like, oh, of course. We had to have a complete shift in our mind set and the way we thought about risk.

And so, in the NRC transformation work, they have come up with a series of initiatives. But one of the dialogs, the core dialog is about accepting risk.

And I know that that nomenclature can be received well or poorly, depending on kind of how you come at this question.

But, for public health and safety regulators, or for the FDA, I mean not -- it's really at the heart of a lot of how we have to deal with risk and its most familiar manifestation with which it comes and sits at the table, which is uncertainty.

So, this is the thing that has to be dealt with. And I know that the staff is, you know, has an initiative on this. And is working around it.

But when Dr. Lyman was talking about kind of societal factors on land contamination and other things, it got me thinking that, you know, is that bottom kind of a better public understanding of risk, or should acceptance of risk?

Frankly, if there was never any chance that anyone would want to live near something, people won't invest in it. So, it kind of -- it dies. It's quick death there.

So, and I think candidly speaking, although this isn't really policy, we don't do energy policy here.

But, for the strong, and getting louder, public policy discussion about whether you want to call it clean air, or you want to call it decarbonization, or you know, and then the various things that people support, depending on their view of the urgency of the problem, they might say I want to do, you know, a carbon capture through forestry projects, or I support nuclear energy, or I just think getting rid of coal and maybe going to natural gas.

But for that dialog growing, it's also not likely that we would be sitting here, at least convening this frequently, on this topic. So, that is an element.

But, without a kind of fundamental stepping back on the public policy dialog around the risk of this technology, about how expert agencies like ours, and external parties are really creating a confidence around that risk, then, you know, I -- we can do -- we can make the investment in expanding the state of our knowledge.

But that seems to be a really important ultimate thing. Maybe not by the people in this room, I don't know.

But, I think that NRC is not wrong to have as an element of its transformation, some kind of looking at how we deal with this. And so, I don't know if any of you want to just very briefly, give a final word on that?

MR. TRUE: You're right. You could have a long philosophical discussion on this.

CHAIRMAN SVINICKI: Well, as our UK colleagues would say, well, we can meet down at the pub.

MR. TRUE: Yeah. There you go.

CHAIRMAN SVINICKI: We can do that later.

MR. TRUE: So, risk assessment and PRA, risk informed approaches, all the things we talk about regularly, are a tool.

And they're just, they're a tool. They're a way to approach something. And like you wouldn't put -- use a Phillips head screwdriver to put a nail in a piece of wood.

You should use PRA where it works. And you should not use it where it doesn't work. There are limitations in PRA.

For example, it doesn't work so well in the area of security. We don't have a good way to characterize security threats in a quantitative way to be able to use that.

But, what PRA gives you is an understanding of how far your requirements go in reducing that residual risk. There will always be some residual risk associated with any technology.

PRA gives you a way to understand that and characterize it. And characterize not only what contributes to it, but your uncertainties about it in a way that I think that transparency and illumination of an understanding you've done.

And you've come to a major decision. It's far better than simply standing behind the set of requirements and saying, I know this is enough. Because you have a basis on which to say, I've gone far enough.

And I think there's a lot of education that probably needs to be done. I think even on the industry side and the NRC side, to truly understand that nexus between what PRA is really doing, and measuring that residual risk.

And helping us characterize our decisions around that residual risk. That we frankly haven't probably gone far enough on as a nuclear community.

The degree to which the public can understand that is a more difficult one. What the public wants to understand is there's no risk.

And how we bridge that gap between the fact that there will always be some residual risk, and the fact that there is a desire to see zero, is something we have to work, we're never going to educate the public on, completely on this.

CHAIRMAN SVINICKI: Well, and on that point, I think Dr. Lyman may want to chime in, please. And I'm over my time. But maybe my colleagues will indulge me. I'll give Ed the last word.

DR. LYMAN: Yes. And on the issue since the public came up, I think my problem with, and I think it was in the original transformation paper, which you didn't approve. But, this notion that the staff needs to accept more risk.

And really, if the Commission is going to be making decisions that are going to potentially change the level of risk to the public, then that has to be communicated.

And the public has to fully understand what those decisions are. And in theory, they should be part of the dialog. You know, that's difficult to achieve.

But, you know, the staff should not accept the --

CHAIRMAN SVINICKI: Well, it is if the principal thing we have is what I'm going to call Amir's chart. Which is unfair, because that LMP chart has been used a lot.

I look at that thing. I don't know what we are trying to tell the public when we wrote that chart up.

DR. LYMAN: Yeah. That does raise an issue on that. You know, transparency came up as one of the objectives of the LMP.

But, my God, you know, I -- I've been struggling with some of the, some of

what's in there. And so, right, that's not going to be the vehicle you're going to what to use to communicate to the public.

I think that it should be clear to them that the NRC is going to change its standard. And they should be able to express, to understand that. And to be able to participate in that discussion.

CHAIRMAN SVINICKI: Thank you. And since I went over, do any of my colleagues have a last question?

(No response)

CHAIRMAN SVINICKI: Okay. All right, with that we will take a five minute break until 10:35. Thank you.

(Whereupon, the above-entitled matter went off the record at 10:29 a.m. and resumed at 10:37 a.m.)

CHAIRMAN SVINICKI: Well, thank you all. And as people are retaking their seats, we will now hear from the NRC staff.

And I would note for any who were following our published scheduling note for the meeting, it indicated one NRC presenter who will not be here today.

But the topics that he was going to cover, will be covered by another member of the panel. And just with that, for information purposes, I will now turn it over to our Executive Director for Operations, Margie Doane.

Margie, please proceed.

MS. DOANE: Okay. Good morning Chairman and Commissioners. We're pleased to be here today to discuss the progress that we have made on our plans going forward with executing our vision to be a modern, risk-informed regulator in the areas of new and

advanced reactors.

There are some parts of the agency that will take years to see evolution to the point that we would say, now that's transformation. This is due to the pace of change in those particular aspects of our work.

New and advanced reactors, as you've heard from the previous panel, is not one of those slow-paced areas. The pace of change in new and advanced technology fields seems as if it's evolving on a monthly basis.

And today you will hear about the concrete steps we have taken to ready our staff, our processes, and our regulatory framework to ensure our success. The pace of change needs to continue to assure that we are ready to address the nation's needs.

For our staff, our most important asset, we are providing training on new and advanced technologies. And we're ensuring that work teams and office organizations are focused on enhancing collaboration and innovation across the agency.

For example, to enhance collaboration, we have merged the Office of New Reactors with the Office of Nuclear Reactor Regulation, or NRR.

I've witnessed the motivation and felt the energy of the staff in this new merged organization, heading for the review of advanced reactor applications. In fact, I spoke at their all hands meeting just yesterday.

For our processes, we have made significant strides to ensure applicants understand the pre-licensing process, and how it can help to identify issues early for more expedited decisionmaking.

So that licensees have predictability in the process, we've identified key licensing topics that need to be addressed in the application. We've established milestone

schedules for every application, and identified unresolved, unique technical issues to keep a sharp focus on the challenging aspects of individual applications.

For Vogtle Units 3 and 4, our staff, with the support of the Vogtle Readiness Group, is on track to meet regulatory milestones for fuel load this fall.

Finally, for our regulations and guidance, we have interfaced with the public, vendors, and industry and other federal partners to understand those aspects that may prove to be obsolete or that are in need of revision to ensure the right size of a regulatory framework.

For protecting -- for ensuring safety, protecting -- protection of the environment and security, we have produced key documents to further these discussions. And I am confident that we are ready to review the applications that you will hear about in this presentation.

I'm often asked, how will the citizens of the United States know that we have transformed our agency? And I think this area gives us an opportunity to show that they will know when we deliver on our commitments for timely and thorough reviews of first of a kind new and advanced technologies, including Vogtle, NuScale, and other new technologies that may come in the future.

Now, I'd like to introduce our team at the table from NRR, who will talk about the essential aspects of this business line and the issues that I just highlighted for you.

So, first as all, as the Chairman pointed out, we have Ho Nieh, who has graciously accepted this morning, to sit at the table. And of course, he knows these issues very well.

So, he'll be presenting. He'll provide an overview of the vision and direction of the reviews and of new and advanced reactors.

Mike King to my left, is the Director of the Vogtle Reactor Project Office. He

will describe licensing and oversight activities associated with construction of Vogtle Units 3 and 4.

Next to him is John Segala, Branch Chief of the Advanced Reactor -- no, that's not really right. John Segala is over here. Sorry.

(Laughter)

MS. DOANE: This is where you can't pay attention to what they gave you.

John Segala is our Branch Chief of the Advanced Reactor Policy Branch in the Division of Advanced Reactors in Non-Power Production and Utilization Facilities, or DANU. You know we love our acronyms, right?

He will talk about the staff's initiatives to modernize our licensing reviews for advanced reactors.

Finally, Ben Beasley is a Branch Chief of Advanced Reactor Licensing Branch in DANU. And he will discuss the staff's readiness to review advanced reactor applications.

So, we appreciate this opportunity to discuss this important issue with you this morning. And I'm now going to turn it over to Ho.

MR. NIEH: Okay. Thank you very much Margie. Good morning Chairman. Good morning Commissioners.

I'm happy to be here this morning. In fact the level of excitement of my morning changed significantly a few hours ago.

I was expecting to be listening carefully from the audience. But now I find myself at the table before you. And this is agility and flexibility of our regulatory process in action today.

So, in my remarks this morning, I'll talk about the vision and direction for NRC's

activities related to new and advanced reactors. Our goal is to make safety-focused, timely decisions consistent with risk-informed decision-making principals.

I'll also touch on the opportunities and challenges before the staff in this area. I'll talk about some of our external stakeholder engagements, and the benefits we've had from those.

And then some of the keys to success. Can I have the next slide, please?

I want to talk a little bit more about the merger of NRR and NRO that Margie had just mentioned. And as you know, in October of last year, we brought together two large business lines at the agency.

And I am very proud and confident to sit here before you today, to let you know that I felt that transition has been seamless. We did not skip a beat in our work.

And that -- this was a major success story for the NRC. And I believe that success was due, in large part, to this dedicated staff of the merger implementation team, who focused very intently on the needs of the staff and the elements that needed to be put in place so that we stayed focused on our priorities, and did not affect the work in any way.

So, we're going to bring together efficiencies from both NRR and NRO as we conduct our work going forward.

I'd also like to say that when we stood up the office, we set an aspirational vision for how we are going to do our work. And that vision is that we make safe use of nuclear technology possible.

And we will be striving to apply the NRC's Principals of Good Regulation in all the work we do across both business lines. Can I have the next slide, please?

Regarding the Vogtle Units 3 and 4 AP1000 construction project in Georgia, the

NRC fully recognizes the national significance of this effort here.

And in fact, with the establishment of the merged office in October, we stood up a Vogtle project office to provide dedicated, focused leadership and attention on the important licensing and oversight activities to support our success in that project.

We are working very, very closely with our partners in NRC's Region II office in Atlanta. And we are continuously assessing the dynamic construction schedule, and adjusting our activities to ensure that we can effectively make our contribution to the success of this nationally significant project.

And you'll hear more about that from Mike King later on in the presentation. Can I have the next slide, please?

Regarding our reviews of small modular reactors, I'm happy to say that we've made great progress with the NuScale review. And we believe we are on track to meet the 42-month schedule that we have established for that review later this year in September.

Just last year, in December, we met a significant milestone, the phase four milestone, where we completed the staff safety evaluation report with no open items. We worked very effectively using risk-informed principals to address 29 highly complex technical issues.

And we're learning from this first of a kind review. And we're going to take those lessons, and build those into some of the future review activities that we are anticipating that you see on this slide before you.

So, I think we made great progress with the NuScale review. And we're learning from it in our work. Next slide, please.

Regarding the interactions with our external stakeholders, the slide shows a variety and array of different organizations that we've been engaging with over the last few years

in the area of advanced reactors.

And consistent with all the work we do at the NRC, the input we get from our external stakeholders is so important, and it is so constructive in how we guide our work for the NRC's mission.

I do want to highlight that the recent legislation that was discussed in the previous panel, such as NEIMA and NEICA, they've helped enable the NRC to enhance its preparations for advanced reactor readiness. And they set very clear expectations for our performance in this area.

So, we value very much the insights we hear from our external stakeholders. We think that helps us really work toward sound policy recommendations to the Commission, as well as clear guidance to the advanced reactor community.

And I'd like to finish with the next slide on my remarks, on sort of the key elements for us to, as I mentioned earlier, enable the safe use of nuclear technologies.

There's three key areas. It's the preparation, the strong commitment to our safety mission, and execution.

So, those are the things that we are going to provide complete attention to. To make sure that we're able to carry out the NRC's mission with determining reasonable assurance of adequate protection, and consistent with our Principals of Good Regulation and how we handle our work in advanced and new reactors.

So with that I would like to turn the staff's presentation over to Mike King, who will talk to you a little bit more about Vogtle 3 and 4.

MR. KING: Thanks Ho. Good morning Chairman, Commissioners. It's my pleasure to provide you an update on the status of NRC's oversight activities related to Vogtle.

The last time we provided an update to you was in June of last year, as part of the annual assessment review meeting Commission meeting.

And since I'm sure you've observed through your visits to the site, construction has progressed significantly during that same time period.

And the staff has been very busy in the background conducting inspections, conducting licensing activities, and preparing to ensure our success in our regulatory responsibilities associated with the Vogtle project.

Now we're only within nine months or so of the scheduled fuel load date for Unit 3 at Vogtle. In fact just last month, Southern Nuclear provided their 315 day notification to the NRC of the anticipated fuel load date of November 23 of this year.

We have signed, enabling us to sign the notice of intended operation. Which we expect to be published in the Federal Register on February 12. So, next week. Next slide, please.

So, our success in delivering our regulatory obligations and commitments associated with oversight of the Vogtle project, is -- requires the coordination across multiple offices at the NRC, and are combined efforts.

Notably, as Ho mentioned, Region II is a key player in this, along with the Office of Nuclear Reactor Regulation, Office of Security and Incident Response, and our Office of General Counsel.

We're resourced appropriately with the formation of the Vogtle Project Office. We have the right expertise.

And we're coordinating our activities through the Vogtle readiness group, or the VRG. This group meets on a routine basis.

In fact, from here to the end of construction, we're meeting monthly at least. And we're proactively looking for risks to our success with the project, and taking actions to mitigate those risks.

When I came on as the Director of the Project Office, you know, late last year, we stood up, we connected at what we call a risk retreat, where we got experts from across those offices together.

We locked ourselves in a room. We said, what could go wrong? We looked at those. We prioritized those. And we've taken actions, or put actions in place to address those risks.

We fully expect there's going to be things we don't anticipate. So, we've resourced appropriately to be able to have the flex capability we need to be able to respond when those unanticipated things occur.

I'll share with you, since my time as a Director of the Vogtle Project Office, I have been impressed with the staff's safety focus, and their commitment too really making our oversight of the Vogtle project a model for modern risk-informed regulation.

On the next slide I'll highlight an example of things we're doing to leverage technology and innovation to enable our success with the project.

And I'll admit, I'm going to fall short of the overview which was given to you by Taylor Lamb, who's sitting behind me. The energetic transformation presentation she gives.

But with that, I wanted to highlight, you know, this was a close collaboration with our Office of Chief Information Officer. We threw away the chains of the normal pace of developing projects like this.

We've rolled our sleeves up. And we were able to develop this within a matter

of a couple of months.

Since then, we've put it into daily practice in our oversight of the project. And it enables us to monitor our progress in the three key areas for our success, licensing, ITAAC, and for those tying in, I know each of you are very familiar with ITAAC.

But, for the public tying in, ITAAC is -- represents the inspection, testing, and analysis, and associated acceptance criteria specified in the combined operating license, which must be met to ensure the plant is built in accordance with its approved design, and is safe to operate.

So, the three key areas, licensing, ITAAC closure, and inspection, are the three key areas which we monitor as closely as part of the Vogtle readiness group.

This dashboard gives us, at a glance, our health of those metrics. And enables automated data-drive reports to help us make informed decisions in a more timely manner, and with less resources involved.

Part of modernizing our approach as a regulator is making data-driven decisions in an efficient way. And the dashboard helps us to do that. Next slide, please.

Licensing is important, and in a particular in construction of a new designed plant. And so, by nature, licensing can be, it's a methodical deliberate process, thoughtful, and can take time.

But, I think what we'll show here today, is that we've been effective applying modern risk-informed principals consistent with our Principals of Good Regulation, to enable us to make our safety decisions associated with licensing actions faster than we have in the past.

And I'll highlight, if you see on the chart, from 2016 to 2018, the number of licensing actions significantly increased. But, the time it took for us to make our regulatory safety

decisions, decreased.

In fact, currently we're averaging less than six months to process a license amendment request, and to make our safety decision. And we've met and we've been able to meet, all the need by dates requested by Vogtle.

So, how are we able to do that? You know, we're really making great use of the pre-submittal meetings.

So, before the licensee comes in to give us their license amendment request, we're having public meetings to engage with them and say, what are you planning to do?

What are the pieces that are safety significant? Where should the staff spend their time? We're identifying complex license amendment requests early.

Defining for ourselves what it means to be successful and meet our acceptance criteria. Having weekly public meetings with the licensee to engage on ongoing license reviews.

And as you've seen in the digital dashboard, we have a lot of metrics monitoring progress and a VRG. And managers across the agency are being held accountable for those metrics.

And it also doesn't hurt that we get head of the line privileges for any of our licensing activities.

I mean, the agency really has put this as a number one priority. And that's evident in the approach that staff across the agency are applying to the project.

So, we're using the reunification of the offices as an opportunity to leverage the successes that we've achieved with the Vogtle project in the area of licensing.

And I'll just highlight that we're working with our partners in the Division of Operator Reactor Licensing on a project to explore streamlined processes for handling license

amendment requests to address low risk ITAAC compliance issues. Because a number of those types of issues have been identified so far with the Vogtle project.

So, to date we've processed a 170 amendments or so. And the forecast for the remaining amendments is decreasing.

So, we don't foresee this, the area of licensing as a significant challenge for us going ahead. Next slide, please.

So, in the area of ITAACs, we've already completed a significant amount of work for ITAAC. All ITAAC to date have either, for Unit 3, have either been reviewed as uncompleted ITAAC notifications or UINs on this chart.

Or have been closed through the ITAAC closure notifications or ICN process. And the UINs are particularly important, because they provide public visibility into the licensee's plan for how the remaining ITAAC will be closed, and the acceptance criteria to be met.

And, it allows us to really front load the work we have to do as an agency. So, a lot of the bulk of the work for reviewing in the ICNs, we're able to accomplish in terms of reviewing the UINs.

As long as they follow what we approved in the UIN, our approval of the ICN that follows, will be much more streamlined.

So, as you can see, for Unit 3, the dark green in that chart, there is an expected bow wave of ICNs to arrive, you know, late spring, early summer time frame.

But because we were able to front load a lot of the work, we feel like we're ready. And the lessons we're learning through Unit 3 reviews, will apply to Unit 4, and we expect to get more efficient as well.

We've also issued guidance for the 103(g) decision that we have to make at the

end. And for those unfamiliar, the 103(g) refers to 10 CFR 52.103(g), where they agency makes a determination that all ITAAC have been met.

And also, the associated hearing process, the procedures have been issued for that if they're needed. And we've conducted a public meeting in the local vicinity of the plant to walk through that process. And next slide.

So, not surprisingly, this is our first time executing the Part 52 construction process. So, we're learning lessons. Important lessors which we're working closely with our partners in Region II.

In fact, I'll highlight Bradley Davis is sitting off to the side. He's one of our Branch Chiefs from the construction organization in Region II.

And we've worked closely with them to incorporate those lessons into our inspection program. And we're also holding onto those lessons for any eventual future construction inspection programs for small modular reactors or advanced reactors.

So, recently our efforts to monitor closely our inspections, prompted us to take a look at okay, what is the collection of inspections that remain?

And we took a close look at those. And optimized those remaining inspections, incorporating all the lessons we've learned through construction to date, in addition to looking at, what are the targeted areas that we are going to inspect?

So, by the time the 103(g) decision is before us in November of this year, we will have accumulated thousands of hours of time with experts in the field looking at all aspects of construction. And we're confident that we're going to have what we need to make an informed reasonable assurance decision.

But, there is lots of inspection remaining to do. And, although we're confident

we're resourced and ready, we're monitoring closely our progress and continuing to bake in lessons learned that we discover along the way.

So, not surprisingly, in a dynamic construction environment here schedules change, this is a challenging area. And an area that we have to monitor closely.

And we're committed to do just that. We're also focused on the transition to operations. And making sure we are ready should the 103(g) decision get made.

And so, in fact recently, we held a couple of public meetings where we discussed our initial thoughts on ROP for AP1000, and what construction, or inspection of Vogtle Units 3 and 4 would look like.

And we're looking to optimize the whole suite of inspections that we're doing across all four units before and after 103(g).

And finally, I'll just highlight that, you know, the staff for, you know, our success is really critical. It depends on the staff, right?

So, and if you're an organization which you know is eventually going to go away, you might naturally have concerns about that. We're focused on that.

In fact, we're ensuring the skills -- we have the skilled staff we need for the entire duration of the project. And that they have some sense of confidence that they know where they're going to go after construction ends.

So, we're cross training staff. We're using the full suite of HR tools we have available, to be able to give folks a sense of confidence that they know they're going to have a home after construction ends.

And it's important for them to stay on to ensure the success of the project through the duration.

So, that concludes my remarks. With that, I'll turn it over to John Segala, who will talk about licensing of advanced reactors. Thank you.

MR. SEGALA: Thanks Mike. And good morning Chairman and Commissioners. I'm pleased to be here to provide an overview of our activities to modernize a regulatory framework for advanced reactors.

The Nuclear Energy Innovation and Modernization Act, or NEIMA, defines advanced reactors broadly. However, my remarks today will focus on our non-light water reactor readiness activities.

We last briefed the Commission on advanced reactors in January 2019. And since then, there continues to be significant stakeholder interests in developing and licensing advanced reactors, including from the Congress, Department of Energy, Department of Defense, and our developers. Next slide, please.

We continue to make significant progress executing our non-light water reactor vision and strategy, and our implementation action plans. And prioritizing our activities to focus on advancing risk-informed and performance-based approaches, and resolving technology-inclusive policy issues.

We are ensuring transparency and openness by continuing to have extensive stakeholder engagement in all of our activities.

In January, we issued our annual commission paper on the status of advanced reactor activities. That provided an overview of our accomplishments in 2019, and our plans for this year.

This has been an agency-wide effort through the leadership of NRR. And has included tremendous support from our partner offices in the Office of Research, NMSS, NSIR,

and OGC. Next slide, please.

As we develop our non-light water reactor framework and address policy issues, we're looking at the safety of advanced reactors in an integrated and holistic manner.

Consistent with NRC's advanced reactor policy statement, we expect advanced reactors to have at least the same degree of protection of public health and safety as the current generation of light water reactors.

In addition, we expect advanced reactors to have enhanced margins of safety and/or use simplified, passive, inherent means of accomplishing their safety and security functions.

We are advancing risk-informed and performance-based approaches to the resolution of policy issues.

This provides predictability and flexibility which allows developers to make early design decisions and tradeoffs between the mitigation and prevention of potential accidents. And to demonstrate equivalent level of safety in new and innovative ways.

Through our issuance of the emergency preparedness for SMS and other new technology proposed rule for public comment, this is an example where the agency is addressing policy issues with technology-inclusive, risk-informed, and performance-based approaches. Next slide.

We are committed to the development of a modern technology-inclusive risk-informed and performance-based framework for advanced reactors. The existing regulatory framework is prescriptive. And was developed with light water reactors in mind.

We have been engaging with the industry led Department of Energy license cost share, Licensing Modernization Project, which is described in the Nuclear Energy Institute's

NEI 1804 document.

And it provides a non-light water reactor framework to facilitate licensing advanced reactors within our current regulations.

As Amir Afzali discussed earlier, the Licensing Modernization Project is a technology-inclusive, risk-informed, and performance-based methodology for identifying the events, classifying the system structures and components, and ensuring adequate defense in depth.

The Licensing Modernization Project builds off of a long history. And it demonstrates integration of past Commission decisions.

As discussed in SECY 19-0117, we request the Commission finds the staff's use of this methodology to be a reasonable approach for establishing key aspects of the licensing basis and the content of applications.

To demonstrate the feasibility of this approach, industry completed six limited scope pilot or tabletop exercises of the Licensing Modernization Project.

These pilot reports, which are available on our public website, have provided insights to the NRC staff on how non-light water reactor developers can use the methodology to demonstrate enhanced margins of safety. Next slide, please.

Developers who submit risk informed applications will help scale the NRC staff's review to be commensurate with the risk and consequences of the facility.

We are in the early stages of engaging with the industry led Department of Energy cost share. Technology inclusive content of application project, or TICAP, which aims to develop the methodology that will take the output of the Licensing Modernization Project, and use it to help risk inform the scope and level of detail of an application.

The diversity of advanced reactor designs makes it necessary to develop a technology-inclusive methodology, as opposed to a more prescriptive guidance that was developed in the past for light water reactors.

So, looking at the slide, starting on the left side, applicants will apply the lens of the Licensing Modernization Project to their non-light water reactor design. And they will identify the events, classify the system structures and components, establish programmatic controls, all of which will be described in the application in a level of detail that's proportional to the risk and safety significance.

Focusing on the right blue application box, system structures and components that are classified as safety related, or non-safety related with special treatment, will be described in the application in a greater level of detail then the system structures and components that are non-safety related with no special treatment.

This will help focus the application content on the -- of most risk significant system structures and components. And will in turn help focus NRC staff review. Next slide.

As a result of the growing global interests in using advanced reactors to address challenges such as climate change and increased energy demand, there's a heightened need to have international cooperation on advanced reactors.

Therefore, the NRC has been enhancing our engagement with international regulators through our memorandum of cooperation with the Canadian Nuclear Safety Commission, and our involvement with the Nuclear Energy Agency and International Atomic Energy Agency working groups.

We are sharing regulatory experience on advanced reactors. And we are advancing risk-informed and performance-based approaches with international regulators on

topics such as our Licensing Modernization Project, and our technology-inclusive content of the application project. Next slide.

The Nuclear Energy Innovation Modernization Act, or NEIMA, was signed into law in January 2019. By leveraging our completed and ongoing implementation action plan activities, we are on track to implement the advanced reactor related NEIMA provisions.

In accordance with Section 103 of the Act, we issued two reports to Congress in July 2019. One on establishing staged licensing processes for advanced reactors.

And the other on developing risk-informed and performance-based licensing guidance that -- for advanced reactors within our current framework.

In accordance with Section 103 of the Act, we also are working to develop and implement guidance for advanced reactors within our current framework by January 2021 in areas such as source term, event selection, containment performance, and emergency preparedness.

In anticipation of the enactment of NEIMA, we began to proactively work on many of these items. And some are now in the final stages of development.

Section 103 of the Act also requires the completion of rulemaking to establish a new technology-inclusive, risk-informed and performance-based regulatory framework for advanced reactors by no later than the end of 2027.

We have formed a rule making working group. And are developing a rule making plan, which we plan to provide to the Commission in April of this year.

Although we are planning to leverage our ongoing activities, such as the Licensing Modernization Project and the technology-inclusive content of an application project to form the foundation of this new rule, we are starting with a clean slate, and looking for new and innovative ways to regulate advanced reactors.

With that in mind, we are planning to continue to have extensive stakeholder engagement on the scope and approach of this new rule.

That completes my remarks. And I'll turn it over to Mr. Ben Beasley.

MR. BEASLEY: Thank you, John.

Good morning, Chairman and Commissioners.

As you have heard, staff and the industry have been preparing for advanced reactor applications. Non-LWR reactor designs are very different and the NRC reviews will be different. Although work continues on some policy issues and guidance development, staff is ready and eager to begin application reviews.

Next slide, please.

As John has just discussed and Amir, Doug, and Alice described earlier, much is being done to prepare for licensing of advanced reactor designs and much has already been accomplished. Staff has been working with the Commission to address policy issues, and we've been cooperating with the Department of Energy and industry to prepare for advanced reactor applications.

In accordance with our vision and strategy, staff has focused on development of knowledge and analysis capability. Staff has been trained on molten salt reactor technology, sodium fast reactor technology, and high temperature gas reactor technology. Our strategy includes training because it is vital that we maintain a skilled, talented staff as we move into the reviews of advanced reactor designs.

Staff is making computer code enhancements and developing models for use in our review of advanced applications. As suggested by the Nuclear Energy Innovation and Modernization Act, we are leveraging Department of Energy codes for faster and less costly

development of our analysis capabilities.

In a couple of minutes, I will talk about some reviews that are underway, including our plans for the acceptance review of the Oklo application. From my perspective in the Licensing Branch, the starting gun is about to sound and we will be off and running. I do want to emphasize that I will be talking about reviews of non-light-water reactors that may be a thousandth of the size of the Vogtle plant.

Next slide, please.

New technologies and new reactor developers necessitate new approaches from the NRC. We are focused on assuring safety and we have excellent guiding principles to do that. The new designs give us the opportunity to use our guiding principles to change the approach to our review.

We recommend to applicants that they engage in frequent and thorough pre-application interactions with us. We are looking for efficient ways to do environmental reviews, and we are changing how we organize our application review teams.

Because much of the current regulation is oriented towards light-water reactors, we need to recapture a previous approach to our reviews. With a focus on safety, staff will make a specific finding on adequate protection in addition to assessing a design against applicable regulations.

Next slide, please.

The recent organizational restructuring has created a Division with three Branches focused on advanced reactors. For near-term applications, staff will perform an integrated review with a focused project team. That project team will consist of a core group of full-time, multidisciplinary reviewers supplemented by a few part-time reviewers. That core group

will reach out to subject matter experts for specific review support which will be at differing levels of effort.

Managers are focused on supporting the core team as they make a determination on safety. We are in the process of physically locating the project team together, and we are planning on providing information technology to improve collaboration within the team and to improve communication with the applicants.

The project team will perform an integrated safety review of applications. An integrated review will rely on first principles and will consider the whole reactor design, rather than dividing it into sections that line up with a standard review plan.

An integrated review is necessary because advanced reactor designs will not fit into the light-water reactor standard review. An integrated review was the approach employed prior to the issuance of the Standard Formatting Content for Safety Analysis Reports back in 1972.

This approach will provide a review focused on safety, but will take less time and effort to reach our safety conclusion. I want to emphasize that staff is not cutting corners or trimming work to gain efficiency. The new designs and smaller plants have less to review and we need to take a different approach.

Next slide, please.

I expect that you have seen this graphic before. We've reorganized it a little bit to clarify the landscape of technologies that we expect to see.

The six applicants shown with a blue-white gradient have submitted letters describing their plans that lead up to an advanced reactor application. We are actively engaged with X-energy, Kairos, Terrestrial, and Oklo. This year, General Atomics, TerraPower, and

Westinghouse will be ramping-up their licensing interactions.

Next slide, please.

We anticipate a substantial number of licensing submittals this year. Notably, we expect to receive a custom combined license application for the Aurora powerhouse from Oklo. Oklo has indicated that they plan to submit two more COL applications for the Aurora powerhouse by the end of the year.

In addition to preparing for the review of the Aurora powerhouse, we are currently reviewing several Topical Reports. We have just completed Safety Evaluations on four of Kairos' Topical Reports. In a couple of weeks, we will be meeting with the ACRS to discuss two of those Safety Evaluations. By the end of the year, we will have worked on a dozen Topical Reports for Kairos. And also by the end of the year, Kairos indicates that they plan to submit a preliminary safety information document. That document will give the NRC the opportunity to review design details and could reduce the level of effort needed to reach conclusive findings once an application is submitted.

Next slide, please.

We expect to receive the custom COL application for the Aurora powerhouse next month, and we will promptly begin our acceptance review. As a first-time applicant, we are working with Oklo to assure that the application is complete and well-supported. We plan to conduct audits during the acceptance review to confirm the availability of information. Taking extra time during the acceptance review to confirm the availability of documentation will also give us a clear path to conducting our full technical review and it will give us confidence in our proposed review schedule. Oklo was supportive of this approach to the acceptance review.

As we begin the Oklo review, we recognize that we are somewhat unproven in

conducting an integrated review that is fully risk-informed and performance-based. But we have assembled a good team with the right mindset, and we are eager to prove that we can do it.

We've been receiving good support as we've prepared for the Oklo review. This review will present significant new challenges for the staff, but I am confident that we will meet our objectives because of the cooperative spirit I've seen.

I'm now going to turn it back over to Margie.

MS. DOANE: Thank you, Ben.

So, I see we're just over our time by a few seconds, but if you'll indulge me for a few seconds more, I just wanted to say -- oh, I'm wrong; it's going the other direction. We are 14 seconds under. But I'm just going to take a few seconds.

As you can see, there are a lot of people involved in all of these, in the organizations that have supported not just in NRR, but in the other offices, like NSIR and OGC -- and I'm sure I'm forgetting some -- oh, of course, Admin and OCIO, as you heard. So, there are many, many offices involved in the work that you see going on here, and that's issue number 1.

The next thing I'd like to point out is that there are people in these very organizations that are at the table that are in the room, and that's why you see such a large audience. So, that shows you how many people are putting their efforts into ensuring that this program is adequately protective of public health and safety, common defense and security, and protection of the environment.

And finally, I just want to thank the staff that helped us put these presentations together because that's always a lot of effort as well.

With that, I'll turn it over to the Commission. We're looking forward to your

questions.

CHAIRMAN SVINICKI: I thank the staff for their presentation.

We'll begin with Commissioner Baran.

COMMISSIONER BARAN: Thanks. Well, thank you all for your presentations and for all your work.

I think we had a good discussion with the first panel on the Licensing Modernization Project guidance, and I'd like to ask some more questions about that. I guess I'll direct the question to John, since you presented on it. The others, obviously, can jump in.

I think it's kind of an obvious statement, but the PRA ends up being pretty critical under this kind of probabilistic approach to licensing. When the Commission considered this approach in 2003, at that time the staff said that it would require the PRA to become part of the licensing basis of the plant with appropriate controls on PRA completeness, quality, and documentation. Is that still what you're envisioning? Would the staff approve a designed PRA?

MR. SEGALA: So, yes, we will have controls on the PRA completeness, quality, and documentation through our planned endorsement of the non-light-water reactor PRA standard. That standard requires an independent peer review, which gives us confidence in the results and may obviate the need for us to do a detailed review of the PRA. If developers choose a different approach, we will, then, have to do a much more detailed review of the PRA.

In either event, under the Licensing Modernization Project, if they come in with an application for that, we would expect a great level of information on the PRA in the final Safety Analysis Report, and that's something that we're starting as we engage on the Technology Inclusive Content of Application Project. That's something that we're going to pursue through that interaction with industry to make sure that the PRA information is adequately reflected.

COMMISSIONER BARAN: Okay. And what do you think about Ed Lyman's concern about what he called common-cause failure with the PRA? When I look at slide 19, it has LMP as the little prism there, but, you know, if the prism for a moment were PRA, I think his point is, well, if that prism were busted in some way and we didn't know it, then event selection and safety classification and in-depth level of the application, everything after that is going to be messed up. What's the staff's view of that concern?

MR. SEGALA: So, I would say whether you do a deterministic approach or a probabilistic approach, either way, the developers and the NRC are going to have to understand and address the uncertainties in the data, the operating experience. So, the big advantage of a probabilistic approach is it has you explicitly identify the uncertainties in the data, which you don't necessarily get from a more deterministic approach.

In addition to that, no matter what approach you take, developers are going to have to come in, demonstrate the design meets the applicable requirements. They're going to have to demonstrate that they meet the fundamental safety functions, and they're going to have to demonstrate that their safety features are demonstrated in a combination of analysis, testing, and operational experience.

Using LMP, LMP requires the developers to determine what the uncertainty is in both the consequences and the frequency of all the licensing basis events. And then, it uses that in the methodology to help you identify risk significance.

In addition, interwoven into LMP is an integrated decisionmaking process where they're going to look at the margins and the uncertainties, and they're going to use that to help determine whether there's adequate defense-in-depth.

COMMISSIONER BARAN: On the question of determining whether defense-

in-depth is adequate, the staff's paper talks about the LMP guidance as including both probabilistic and deterministic assessment techniques to establish defense-in-depth. Can you talk in a little bit more detail? Walk us through a little bit how deterministic factors would be used in that analysis. What's the role of deterministic factors or engineering judgment in determining the adequacy of defense-in-depth?

MR. SEGALA: So, first of all, I mean, you're going to use a probabilistic risk assessment and you're going to use risk to identify the events and classify the system structures and components. Then, built into LMP, they have a process by which you're going to look at, do a deterministic conservative analysis of all your design basis accidents. And you're going to do that to demonstrate you meet the NRC dose limits, and only crediting safety-related equipment.

And then, also, as the three pieces of defense of the three key elements of the Licensing Modernization Project, defense-in-depth, ensuring the adequacy of that will be demonstrated through a combination of engineering judgment and deterministic considerations. So, it's a combination of risk and deterministic approaches which makes it risk-informed.

COMMISSIONER BARAN: And how detailed is the guidance in that area? I mean, is there a fair bit of flexibility in how that will be presented by the applicant to --

MR. SEGALA: In terms of the defense-in-depth?

COMMISSIONER BARAN: Yes. So, is there kind of one particular way you would expect to see the defense-in-depth analysis look in terms of the combination of the probabilistic and deterministic factors? Or you think it's going to be kind of variable in how that would look?

MR. SEGALA: Well, first of all, I think we would expect in the application to have defense-in-depth described really well.

COMMISSIONER BARAN: Okay.

MR. SEGALA: But the NEI 1804 document has extensive discussion on defense-in-depth. Like I said before, it's interwoven into the overall process. So, LMP is an iterative process. As you go through your design development, you're going to be iterating through LMP over and over again. And defense-in-depth is built into that.

And so, they have a whole bunch of different processes. You're going to start off looking at the five layers of defense that come from IAEA and they're going to be looking at that and make sure that there's independence between all the layers of defense.

They're going to be making sure that there's a balance between prevention and mitigation. They're going to be looking at the SSCs and making sure that there's adequate redundancy and diversity. They're going to be looking at the design features, and they're going to be setting up performance criteria for those design features and, then, establishing programmatic controls that they're going to use to demonstrate that the capabilities and reliabilities of those design features are maintained for the life of the facility. They're going to look at the margins of the licensing basis events with the uncertainties compared to the targets. They're also going to be looking at the integrated risk of the overall facility, adding up all the frequency-consequences of all the licensing basis events, and comparing that to the NRC safety goals. So, the defense-in-depth process has you look at how much margin there is between the integrated risk and the NRC safety goals.

COMMISSIONER BARAN: Staff is also proposing to use this approach to determine the necessary level of detail on the application and in the staff's review of the application. How are we going to determine in advance of reviewing an application which elements of the application are not safety-significant and, therefore, could be less detailed? I'm

trying to figure out, is there a chicken-and-egg problem here or not really?

MR. SEGALA: Well, first of all, what we're doing with the Technology Inclusive Content of Application is we're developing a methodology. Like we have for light-water reactors, we have an SRP, a Standard Review Plan, and it's very prescriptive for each chapter. We're going to design an application. It's technology-inclusive, so it has to be more of a methodology.

But one of the main focuses that we're going to have is looking at the fundamental safety functions. For light-water reactors, that's demonstrated through the General Design Criteria, that you have reactivity control, heat removal, and radionuclide retention, but those become technology-inclusive. They're very important, and we're going to be focusing on those. And so, the developer is going to have to demonstrate the design meets those; they meet the regulations.

And so, if you take a situation, you know, a hypothetical example where, if the developer can demonstrate that the fundamental safety functions are not impacted by, let's say, a secondary side of the plant, then we would expect that the secondary side wouldn't be described in as much detail as it is currently for light-water reactors, where the secondary side can have a much greater impact on the fundamental safety functions.

COMMISSIONER BARAN: So, it's not that the application wouldn't address it? It's how it would address it?

MR. SEGALA: Yes.

COMMISSIONER BARAN: It would be talking about why it wouldn't in this example affect the secondary systems, and then, there might be fair bit of detail on that part of the application and less detail than on the secondary side?

MR. SEGALA: Yes, but there will still be information on the secondary side,

so that we can do an independent review and make sure that they haven't missed anything.

COMMISSIONER BARAN: Okay. And then, some of the new reactor designs or concepts involve pretty small reactors which may involve multiple reactor modules. How would the guidance deal with multi-module issues?

MR. SEGALA: So, this is something that the NEI 1804 document does that is maybe more restrictive than what we currently do for light-water reactors, but it explicitly has built into LMP that you're going to address multi-module as well as multi-source. So, if you have, let's say, a molten salt reactor and you have fuel-salt mixtures going through the reactor, but may be going through other parts of the plant, and so, you've got to make sure that you're looking at the whole risk of the overall plant rather than just the reactor.

For multi-module, if you're sharing systems between all the modules, then LMP is going to have you include all the modules in your PRA that you use for LMP. And so, you're going to have to do the whole methodology with a larger PRA looking at all of the modules.

And then, in addition to that, when you start getting into external hazards, you're going to have to look at what's the likelihood of having an external hazard, you know, damaging multiple modules at the same time. And so, if you look at the frequency-consequence curve, I know that it gets confusing, but on the Y-axis, when it looks at the frequency, it's per plant year versus what we typically see as per reactor year. So, built into LMP is looking at multi-module. They want to make sure that we understand what the risk of the overall plant is.

COMMISSIONER BARAN: Okay. Thanks. This is very helpful.

CHAIRMAN SVINICKI: Thank you.

Commissioner Caputo?

COMMISSIONER CAPUTO: Good morning.

Thank you, Ho, for your flexibility and agility in being here this morning. I'm just going to take a moment to say thank you, also, for your leadership as Director of NRR. You've accomplished a lot already in your time there. I want to also observe that while these accomplishments may be a reflection of your leadership, obviously, they're the results of the staff on your team and their hard work. And so, my thanks, also, to the folks in NRR and the newly-incorporated New Reactors and to everything that's been achieved so far.

In particular, Paper 19-117 in front of us regarding the technology-inclusive, risk-informed, and performance-based methodology, I find the paper very thoughtful and I appreciate the hard work that went into that. Also, on emergency preparedness which the Commission handled recently as well.

Obviously, the staff paper, the Advanced Reactor Status Report that I reviewed in preparation for this meeting also outlined a lot of work being done in training and readiness with the staff, computer modeling, code standards, and stakeholder outreach. So, that's a really broad scope of work.

The one observation I have in reviewing a whole range of papers preparing for today was a lot of these, but, particularly, the status report, stressed progress and used words like "readiness," which I have to admit, when I finished the paper, I felt like we were sort of trying to convince ourselves that we're making progress. Each step in a journey is progress, but at some point what matters here is our end goal, what it takes to reach it, and a clear, transparent, shared understanding of how and when we're going to get there. At some point, we're no longer planning. It's pencils down and there's work to be done.

In keeping with that, beginning with the end in mind, we have a statutory deadline to do a rulemaking by December 31st, 2027. So, I guess my first question is, the

enclosure to the Advanced Reactor Status Paper stated that the staff will bring a rulemaking plan to us for that rule sometime in 2020. When in 2020?

MR. SEGALA: It's April.

COMMISSIONER CAPUTO: Thank you.

MR. SEGALA: So, that rulemaking plan has been drafted. It's going through management review at this point.

COMMISSIONER CAPUTO: Concurrence chain? Another opportunity for transformation.

MR. SEGALA: They have not seen it yet.

MS. DOANE: Yes, we have not, but I do want to say that the staff has put a tremendous amount of effort into making sure that this approach -- I want to emphasize this -- this approach is really trying to really start with a clean slate and really rethink these issues. So, the rulemaking plan is we're particularly focused on making sure that it doesn't just look like, you know, something just like Part 52. We're really thinking broadly. So, that's why you don't have it right now. They've done a lot of thinking. We've had a lot of engagement, and as we said --

COMMISSIONER CAPUTO: Well, I look forward to receiving it.

Another objective we have is the timely, efficient reviews of applications once they are filed. So, considering we have a range of applications that are going to come in and other topical papers, et cetera, to what extent are we going to be ready when these documents are filed with us or are we still going to find ourselves in a position of revising the documents that we need to use in sort of, you know, completing our preparations on the fly, once we're already faced with applications?

MR. BEASLEY: I'll answer that, Commissioner. We do have some review strategy developed for the staff to use to guide their review. The staff that will be on the project team for the first applications have been working in the advanced reactor group for a few years. They're familiar with the designs. They're familiar with the policy issues. And so, they are ready to address those, and as I mentioned, they have a different mindset and they're eager to prove that they can do it.

In addition, management is looking to build on the experience of the first applications, to streamline the processes as we potentially could receive more applications. And the integrated review and the project team approach should make a big difference in being able to review these in a timely manner.

COMMISSIONER CAPUTO: Okay. So, just to continue with my concern, I reviewed the Advanced Reactor Status Paper materials, the public-facing materials on our website, the mid-term and long-term plan, but I have to notice, with few exceptions, that the information articulating what work remains to be done and the schedule for completing the work is noticeably absent. So, to me, that's kind of the essence of a status report. Without that information, I can't really discern whether we're on track or not.

And to add to what the Chairman mentioned earlier about the FDA witness that we had last week in our meeting on medical isotopes, he spoke about how candor regarding FDA's lengthy approval times ultimately drove transformation of their process and dramatically reduced their review times. But what resonated with me is how he talked about candor driving transformation.

So, licensing advanced reactors is obviously a very big challenge for us. There's a lot of focus on it. It's inherently transformational. But if we're going to have confidence

that we can manage this challenge, I think that confidence has to be built on a schedule that articulates the work to be done and when it needs to get done in order to support ultimate completion.

For stakeholders to have confidence in us, I think they need to be able to track our progress. And I think right now, certainly from what I saw in the public-facing documents, that's very difficult. Congress has invested $40 million in our effort so far, and at least one Senator is asking what we have to show for it.

So, Ho, I know you've only recently acquired the responsibility for this area. I appreciate you taking it on. I know Rob is recent to his leadership position. There have been management changes in executing the merger. But, now that you both have your feet under you, I feel like it's time to be candid and transparent. Do you have a clearly articulated punch list with deadlines for building this regulatory framework and conducting the reviews?

MR. NIEH: Thank you, Commissioner, and I appreciate your comments at the outset. And I would say that the success of NRR thus far has really been all for the staff. I think the leadership in the office, you know, we've done a great job setting division, but none of the accomplishments that NRR has achieved could have been achieved without the diligent work of the staff and in our partner offices. So, I really appreciate a lot of the work that was accomplished by NRR and the Regions over the last year or so, and it's really their efforts that really took us to where we are today. But thank you for the feedback.

Yes, kind of four months after the merger, after taking the leadership of the new reactor business line, there are a number of things that you've provided in your feedback about the clarity that we can present to the external stakeholders in terms of what really is our level of readiness in terms of being able to do safety-focused, timely reviews.

And in our discussions with staff, there are a variety of things that you have pointed out where there are many individual projects that do have specific milestones and deadlines to them. Perhaps there is an opportunity for us to improve how we're presenting that and tying that all together into a bigger-picture vision. So, I'd like to take advantage of the opportunity here in coming in with a fresh perspective to look at how that is rolled up and being presented to our external stakeholders.

Having said that, I think that I don't see a barrier right now in terms of an early mover license application coming in. I think, as Ben noted and as John noted, we've been spending many efforts over the last several years working with our external stakeholders to talk about what the key issues are going to be in any of the near-term licensing activities. So, I have the utmost confidence in the staff that they have, through the extensive discussions that they've been having with designers and other industry stakeholders, as well as the public, that they've focused on the key issues that need to be addressed in the review.

And as John had pointed out, too, we're going to learn from the work we get in from those first movers, and that will even help us do better in terms of creating clearer guidance that designers can use and reference in their future application work for us.

So, I certainly respect and appreciate the point about are we really providing clarity in our level of readiness. We're not at all trying to deflect from that and say that, you know, we're totally ready, even though the things you might see might not provide a clear picture of all the details, but I do feel we're working on that and we will be successful when we have a near-term application come in, because we've done a lot of work already and we can improve upon that going forward in our guidance.

COMMISSIONER CAPUTO: I would just make the observation that I think one

of the things that we need, just based on the level of profile here and external focus on the need to move forward with advanced reactors, that we really should be in a position to be able to clearly articulate what our work plan looks like, when we expect to be accomplishing that work.

We've done that, I think, with Vogtle and the dashboard and really being able to provide sort of a public record of where we stand in terms of completing ITAAC. And I think that that kind of an effort here would go a long way toward building confidence in our external stakeholders that we are ready. Because I think if we simply say that we're ready and that we've made progress, that's fairly difficult to discern without the measure of being able to track what we've accomplished and what we plan.

Thank you.

CHAIRMAN SVINICKI: Thank you very much, Commissioner Caputo.

Next, we will hear from Commissioner Wright.

COMMISSIONER WRIGHT: Thank you.

We're still morning. Good morning. Yes, barely.

So, I kind of want to follow up a little bit with what's been discussed here and the questions that have been raised. I've heard -- Ben, it came from you, and then, Ho just mentioned another version of it, and I want to see if we can define it a little bit better -- I've heard you say "efficiently". I've heard you say "timely manner," and I've heard you say "timely reviews". Can you define that for me? I mean, what is that? What do you mean when you say "timely"? What is that? I mean I hear it.

And I will tell you this. I went to EMBARK yesterday. Wonderful afternoon. I could have spent all afternoon with them. A lively discussion. It was fun. And I'm going to go back.

We have taken subsequent license removal and we've defined an 18-month timeframe. So, we know that. In other areas, we're defining those things as well. Vogtle, outstanding what they've done, the readiness group there and being ready for the ITAAC. You've got a plan for that. You've got it defined.

And I'm trying to get to, because it is important, the advanced reactor stuff. You've got people coming in. Oklo's coming in. You've got all the others coming in. I'm trying to get a sense, what is the timely review?

MS. DOANE: So, thank you for this discussion.

And so, I just want to, first, make a bit of a distinction. So, reviews on specific licensing, I believe that, Commissioner Caputo, you're talking about our readiness plan where we will have all of the guidance in place, which is important because, when you have the guidance in place prior to the applications coming in, then you streamline your licensing. So, that's the overall plan for having guidance and other documents and completing the rulemaking. So, these are good questions and we'll take that feedback to make sure that we're being clear about what those deadlines are. That's on the one hand.

On the other hand, historically, and as you've heard with the other panel, we've had to make decisions when we didn't have documents in place, and we're relied on engineering judgment and particulars of an application. So, we have always had to make, and have historically in many different licensing cases, had to make case-by-case decisions when the guidance documents either aren't there at all or aren't adequate on those issues.

So, when we're talking about our readiness, we're saying we're far enough in the work on our guidance documents and in our thinking about the framework. And this is well-informed by other federal agencies, by the vendors, and by the public. So, we're far enough

along that we are confident that we will be able to make those case-by-case decisions.

Okay. Now, turning to the case-by-case decision, I'll turn to this other group to let them put more meat on the bones. I'll tell you at a very high level we've committed to 36 months for a reactor application in NEMA, but, as Ben has pointed out, non-light-water reactors could be, there could be a significant difference. Some of them could be a large non-light-water reactor and it would be advanced, and then, you could have a very, very small. So, we wouldn't want to say that a one size should fit all in a regulatory view. And that's really what we're trying to achieve with this new rulemaking, is to really think about that.

So, with that explanation, I'll turn it to you.

MR. NIEH: Thank you, Commissioner, for the question, and maybe just a few thoughts to complement what our EDO said, Margie.

In terms of timeliness, as Margie pointed out, we had made some backstop commitments, let's say, in terms of meeting a schedule in what the Nuclear Energy Innovation and Modernization Act asked for. But, looking deeper than that, I think what we're trying to present here, sir, is that we want to fully take into consideration the substantial differences of the designs that may come before us for review, and understand what the risks are, what the hazards are, to come up with a very realistic timeframe for a review. I think, at the same time, we want to be very careful not to overpromise what we can do.

And I thought the discussion on safety focus and use of PRA and risk information was quite enlightening because we are going to use some of those tools to help us scope these reviews. So we really understand what does it take to get to that finding of reasonable assurance of adequate protection in our licensing work.

And what was interesting about the debate on the PRA part was, yes, I fully

acknowledge that there are uncertainties with the technology, but I do believe that there are a lot of things we do know that can help us have more confidence in determining how much time we need to spend in areas where we may have uncertainties.

And a point that Ben made in his presentation that I really think is worth underscoring, too, is that this integrated review that a core team will do, we want to look at the big picture rather than overly focusing on any one individual pixel of that picture. And I think that concept is really going to help us work a lot more efficiently where we focus on reactivity, heat removal, and retention of radionuclides as really the fundamental safety things that we have to be really concerned about.

And if we need to introduce subject matter experts in any narrow area, we'll bring them into the review, get the input that they need, and then, move them back on to other work. But we really want to focus on what is most important in these reviews.

But I think realistic schedules is something that we're going to challenge ourselves with. We should not be satisfied with the backstop that we've provided in our reviews. And it has to be a schedule that kind of makes sense for the design in many ways.

Thank you.

COMMISSIONER WRIGHT: Anybody else?

MR. BEASLEY: So, I'll add on, if I may, and I hope I won't get in trouble by going too far out on a limb about talking some specifics for schedule. As Margie mentioned, 36 months was the backstop. But when we're looking at microreactors, you know, that's just widely unrealistic to be able to do something. And my thinking is down the road, after we have been reviewing a particular design -- you know, the first application, of course, is going to take a little bit more time.

But I worked on the license renewal, optimizing that schedule down to 18 months. I don't see why we can't do the same or better on an advanced reactor design, a microreactor.

I do have underway right now a group, a working group within my Branch, to look at optimizing the schedule even further. What can we do to reduce the administrative schedule time? So, we are looking at that. We're pushing every button trying to be creative, innovative, and come up with approaches that enable us to focus on safety and not be as burdened by the administrative processes that take a lot of time. So, it's a work-in-progress.

COMMISSIONER WRIGHT: So now we're getting where I was hoping we would go. The innovation part of this thing is, I think, where we're really trying to -- it's kind of where the nut's at, you know. You've got EMBARK set up. I think even within some of the business lines you've got innovation teams possibly talking about things. They're kind of like free to think, how would we change; how would we do it better, different, without compromising our mission? And if that's going on, congratulations about that. I think it's something that's really needed. It works toward what we're trying to do in transformation.

But I think when we're in this particular space of advanced reactors, the focus from outside is huge, and I think we're wanting to be able to tell the story a little bit better. And I'd just say, any way you can help us do that, I guess that's where I'm coming from.

MR. NIEH: And maybe if I may, Commissioner, just one comment to that.

COMMISSIONER WRIGHT: Sure.

MR. NIEH: I think the agency's effort to transform, being led by the EDO here, has really inspired all the program offices to really critically look at how they're doing their business here. And as you mentioned, you visited EMBARK yesterday, and hopefully, it was very clear to

you that, within the operating reactor and new reactor business line programs, that spirit is really in the air. We are going to challenge ourselves and look critically at how we work, just as Ben mentioned, because some of the tools and practices and processes that served us well 20 years ago probably aren't the things that are going to serve us well in this new environment with dramatically different technologies, much lower power densities, and consequence profiles, and things like that.

So, we're challenging ourselves with how we execute the requests for additional information process. We're looking at new ways of doing that. We're leveraging audits of what we receive from the applicants rather than going through the formal RAI process.

And there's a variety of things, even looking at how we can streamline what we include in a Safety Evaluation Report. Like what is the necessary information that is in an SER that really provides the basis for our recommendations? Do we need to have long lists of reference materials or pages and pages of background information? So, we're trying to really stretch our thinking in terms of how we can work in a much more modern, risk-informed way.

MR. BEASLEY: If I could add one more thing, looking at prior review efforts, it is evident that the thing that slows the process down substantially are technical issues that come up during the review. And that's why it is so important to have the high engagement pre-application. So, if we engage with the applicant and they have a good understanding of our expectations, that really produces a higher-quality application. And that's the thing that will allow us to stay on schedule more than anything else.

COMMISSIONER WRIGHT: Thank you. Thank you.

MS. DOANE: And we'll take your feedback, though. You're saying that we need to do a better job communicating this. And so, we'll take that feedback.

Because, as everyone has said, and Ho has really -- I can tell you I just did the all-hands meeting yesterday, and I'm telling you, the focus on making not just timely decisions, but effective decisions, decisions that really consider these new issues well and provide that level of confidence; the work, the pre-work that's necessary for non-light-water reactors; the review of non-light-water reactors, it's enormous and it is going to be effective.

So, we take that back that we need to communicate better.

COMMISSIONER WRIGHT: Well, to be completely honest about it, I want to do a better job being able to explain it. And I'm looking to you to help me do that.

MS. DOANE: Yes. Yes.

COMMISSIONER WRIGHT: Okay.

MR. NIEH: If I may, just one more point. Again, we're kind of looking under the hood here about how we lead and manage our programs within the NRC. But we've worked with the advanced reactor staff. We internally created a set of, let's say, guiding principles for how we're going to approach a review for an early mover application.

And one of those -- Ben touched on this point -- is our decisionmaking. I mean, we found -- and we're a continuously learning organization -- we found that sometimes in the past we've spent a lot of time on just making a decision, right? And sometimes we went round and round. So, we're going to go into this with the mindset -- you know, we've already met with the leadership of the partner offices in Nuclear Material Safeguards and Security; Research; Nuclear Security and Incident Response to ensure that, when issues come up that need a decision, we are going to elevate those to the right level very promptly and reach a decision in a timely manner, so we don't unnecessarily accrue additional effort that's not necessary to get to a decision.

COMMISSIONER WRIGHT: Thank you. Thank you, Chairman.

MR. SEGALA: Yes, I just wanted to add, one of the things that we did with the NRR and our own merger was we moved Advanced Reactors into the same Division with the Nonpower Production and Utilization Facilities. So, one of the things that we're doing is, now that we're merged with them, that is, trying to learn from them as well. How do they do reviews of research in test reactors that are smaller? SHINE, for example, they did the construction permit in a reasonably quick time. So, that's another area where we're reaching out to our partner Branches in our Division to try to learn things, because we're all faced with reviewing new technologies. And are there things that we can leverage that they've learned to help us do our reviews quicker?

MS. DOANE: I'm sorry, just one more thing. I just wanted to add that we did mention our partner offices. And I just want to mention that we have done very early work with, also, OGC, so we can identify any legal issues, and with the partner offices, NSIR, other offices, so that this is not something that's just going on in NRR. It really is carried out throughout all the organizations that are participating, are looking at this with equal focus to ensure that we really think about how we can make better decisions in a way, because they'll be more timely and they will be focused on the most safety-significant issues.

COMMISSIONER WRIGHT: Thank you.

CHAIRMAN SVINICKI: Well, thank you.

And we've run up very close to noon, but I would like to share some thoughts, even though I think folks are getting a little restless in their chairs.

But this has been a very interesting discussion, and I sometimes say that we all kind of view issues through the prism of the experiences that we've had, which are, if we're keeping our eyes wide open, sometimes humbling. Because what's that statement? Life is

what happens while you're off making other plans.

I've been on this Commission when we thought we would have 28 Vogtle 3-4s going on. Can you imagine, Mr. King? That might have been interesting to try to do 28 of those concurrently. But this is where we find ourselves today.

And I agree with what's said, and I found it sometimes frustrating, as I have tried to vocalize and talk about our work for preparedness and readiness for advanced reactors, the fact that there wasn't, other than kind of near-term, mid-range, and longer-term. We had binned the general sense of what we needed to do into those categories, each of which I think is five years. But it was hard to give the particularity to people who asked me about it.

But, reflecting on how much can change in 10 years, and the fact that, until NuScale came in, when I started on the Commission, every year we were told the first SRM application is coming in next year. Now one did eventually come, but the "when" of that was not clear and we planned for it with great confidence year after year after year.

The advanced reactor landscape is difficult. It's coming into better focus. And what I see us doing in my observation, which I don't think is inconsistent with the observation of others, is, as the focus gets clearer, you know, we've got the chart now with the handful of blue gradient that's interesting coding of the pre-application engagement. So, we've got some companies that are coming in. They want to enter pre-application engagement. So, the picture is getting clearer.

And I think what we do, then, is we go back and restack and reprioritize. DOE gets gobs of money they didn't ask for, you know, and then, they engage with us. And they got a chunk of money for regulatory development, which, again, as I said, once you clear up, that seems a little strange. You know, we engaged immediately on that when they had that funding

and received it. You know, how do we make it meaningful for the public resource that's being invested there? We can give them ideas on what we would de-risk if we had the money. So, I think those are meaningful discussions.

But, noteworthy to me, and I never forgot, before we ever had an SRM application in-house, I asked some vendor in that community -- it doesn't matter who they were because I think I've tested this answer with other advanced reactor vendors since then, and I've gotten a uniform answer. The question was as follows: if you were coming into NRC for an SRM, an advanced reactor design, and I offered you the following proposition, I said, "I can review it in four years with a 75 percent confidence that you would get a regulatory outcome in 48 months or I'll put you in a different lane and I could possibly do it in two years, but I only have 25 percent confidence that you would get it, and it might be longer than that." I said, "Which do you choose? And it has to be one or the other." Every single vendor I've asked has said, "I would pick the four years," because certainty and transparency, and something that was on Rob Taylor's slide that Ho presented, it's performance and execution.

And so, let me return by picking on Mr. King again. You know, is Vogtle on the original schedule by the constructor or on our schedule and we kind of pace along with the schedule the project takes? Those aren't exactly as it was initially when I was here for a limited work authorization, even before license issuance.

But the important thing for NRC to do is to build its confidence and have increasing confidence that we can perform when the picture comes into focus; that our processes are ready.

And the other thing is that, you know, two people who see something from a different standpoint worry about different things. Often, I'll meet with colleagues and they'll say,

"Well, our biggest risk on this project is probably this." And I'm like, oh, gosh, you think that's the biggest risk? I think something else is the biggest risk, because we're all looking from wherever we're standing inside.

I love this place, but there's organizational tendencies in every large organization. And if you were to ask me, am I more worried that NRC would put a plan in place that would have tremendous granularity, and no matter what happened in the outside world, they would continue to diligently proceed along that plan, that is probably our greater organizational tendency than something that Project Aim taught us, which is that we've got to be more agile because life is what happens while we're here at NRC making our plans to get ready. If we get ready for molten salt, there's a good chance it won't be a molten salt.

It's always a little uncomfortable to have to go out and represent when we don't have everything slotted into place and say, "But there is readiness that is being developed and that is growing at NRC." I've been here long enough that, you know, I can say it. It's a thing you have to convince yourself of; you have to convince others of.

But I think the agility -- I look at the elements of our plan that we don't have in place with a detailed schedule and I say, well, we're maintaining fleet of foot. You know, we're trying to cover our bases.

And so, I do appreciate that the staff is trying to balance its tendency to love a detailed process with a world that isn't going to turn out exactly as we forecast it.

Mike, you mentioned the tendency to want to take what we learned on Vogtle 3 and apply it immediately to Vogtle 4. I think we are getting more candid, and that is important.

Part 52 isn't perfect. And so, hopefully, in Part 53 or Part 50X, or whatever we're calling it these days, we're going to reflect that and we're going to do our best.

But I think the other thing I can say about NRC is we do a gosh darn lot of listening. I think that in terms of federal agencies we listen as much as any of them, maybe more. So, if there are concerns that are emerging in our stakeholders and the regulated community, we don't always respond to what they say with the exact answer that they would like, but it's not for lack of listening.

And with that, I don't know, Mike, if there's anything you want to say in terms of Vogtle 3 and project execution there and agility.

MR. KING: Well, I referred to the lessons learned along the way through construction. And I can tell you, we've certainly challenged ourselves to make some hard decisions on how we can best incorporate those lessons along the way. And we're certainly keeping good notes for the eventual CROP 2.0, as we'll call it, the Construction Reactor Oversight Process, for the next evolution. So, I'm confident that we will definitely, if we were to build the Construction Reactor Oversight Process today, it would look significantly different.

CHAIRMAN SVINICKI: And I did have one actual question, which is rare for me, but it's for Ben. And I don't want to put you in a bad spot. But, as you all look at regulatory engagement, as we look at having a process, kind of the answers you gave to Commissioners Caputo and Wright on we're continuing to try to look at the 18-month, how do we develop 18-month for subsequent license renewal? How can we push ourselves?

I actually said once I think -- and I'm going to call out for Mr. Monninger who's in the audience here -- because I said something, and I'm like, well, if it was like 1 megawatt, could you do six months? What would that look like? And he told me later -- he told someone else -- "I almost fell off my chair when she said that."

But, you know there is more or less work, depending on the novelty, depending

on how much pre-application engagement on issues that we've sussed out, and then, tailoring the content of the application to the pre-application engagement and saying, "You're going to need more information on this, I think, and probably don't need to do as much work over here."

But something you've got to marry up to is the Advisory Committee on Reactor Safeguards. So, this is the bad, the hard part of this question. And I know you all have to go in front of them, and they're, in my view, much more fierce than the Commission.

(Laughter.)

So, I don't want to get you crosswise with them, but is it true to say that, if you have to meet the form and structure of the way the staff engages the ACRS, if they came and were willing to be adaptive in their processes -- which, by the way, they have communicated that they do want to be open to that -- is that something that we're going to be able to marry those things up?

MR. BEASLEY: Yes.

(Laughter.)

CHAIRMAN SVINICKI: That's confidence. I like that.

MR. BEASLEY: So, we are talking with them specifically about the Oklo review, but also about how to improve our engagement with them, to reduce the timeframe.

Back to the license renewal, 18-months schedule, the thing that frustrated me about trying to optimize that schedule is about two-thirds of our time was administrative process. We had a draft SER after about a third of the review.

And so, as we're trying to really make this shorter, we've got to address that administrative burden. And so, yes, we are engaged with the ACRS. We are talking with them, and they have expressed willingness to work with us. So, that's why I was able to say "yes" so

easily.

CHAIRMAN SVINICKI: Okay. Thank you.

And with that, I know I am between us and lunch. If none of my colleagues have any final thoughts, then thank you all very much.

And we are adjourned.

(Whereupon at 12:05 p.m., the proceedings were adjourned.)