UNITED STATES

NUCLEAR REGULATORY COMMISSION

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MEETING WITH ADVISORY COMMITTEE ON REACTOR

SAFEGUARDS (PUBLIC)

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THURSDAY,

DECEMBER 6, 2018

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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 10:00 a.m., Kristine L. Svinicki, Chairman, presiding.

COMMISSION MEMBERS:

KRISTINE L. SVINICKI, Chairman

JEFF BARAN, Commissioner

STEPHEN G. BURNS, Commissioner

ANNIE CAPUTO, Commissioner

DAVID A. WRIGHT, Commissioner

ALSO PRESENT:

ANNETTE VIETTI-COOK, Secretary of the Commission

MARIAN ZOBLER, General Counsel

ACRS MEMBERS:

MICHAEL CORRADINI, ACRS Chairman

RONALD BALLINGER, ACRS Member

DENNIS BLEY, ACRS Member

CHARLES BROWN, ACRS Member

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

(10:03 a.m.)

CHAIRMAN SVINICKI: Well, good morning, everyone, and welcome.

The Commission meets in public session this morning to have one of our periodic meetings with the Advisory Committee on Reactor Safeguards. We will hear on a number of different topics today.

And, again, the committee produces a series of letter reports throughout the year on which they provide advice and recommendations to the Commission. And we will hear only a selection of topics today, but I believe the current ACRS Chairman, Dr. Corradini, will have an overview of the work of the committee from the most recent period in his opening part of the presentation.

Before we begin, does any member of the Commission wish to add any opening remarks? If not, then I will turn the ACRS presentation over to the current chair, Dr. Michael Corradini. Welcome.

MR. CORRADINI: Thank you.

CHAIRMAN SVINICKI: Please proceed.

MR. CORRADINI: Thank you very much.

Could I get the first slide, please?

Okay. So as the Chairman said that I'll be giving you an overview, broken up into a couple of sections, first of all, our accomplishments over the last period, which was approximately six months or maybe since April, and then what looks out to the future.

So since our last meeting with the Commission in April, we

have issued 13 reports, and I will try to go through them briefly. One is the draft proposed rule emergency preparedness for small modular reactors and other new technologies. I will point out that Dr. Bley will be talking about this. All I'll point out is this is part of a larger staff effort in planning for advanced reactor applications, and I'll mention a couple other of the activities that fit into that.

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Also, we will be talking about the draft digital instrumentation and controls interim staff guidance, or as lovingly known as Digital I&C-ISG-06, Rev 2. And, again, this is an ongoing activity. Member Brown will be talking about this next as part of our discussion with you, and its efforts that we tend to work on with the staff as they continue to develop the digital I&C plan.

The next topic that we will be talking to you about today is the report on the safety aspects of the APR1400. So this is the final letter report. We have a number of subcommittee meetings, and I think a handful of interim letters to you about this, which essentially is the culmination of the design certification effort, which was worked on over about three years' time between the staff and working with the ACRS.

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On top of those three areas, which you will hear about in more detail later, I wanted to go over some of the other reports that we have presented to you. One is on the draft SECY paper functional containment performance criteria for non-light water reactor designs.

This is, again, another key piece of advanced reactor efforts

by the staff, which we -- and I think it's in front of the Commission now -- that we commented on and provided you a letter report.

The other one is on safety evaluation of WCAP-17936, Rev 2, and I won't read the title. What it really is, is a review of the staff assessments of the needed protection for cabling in-containment to properly make sure there are no debris that are generated due to any sort of accidents, and that they are properly protected. And so we went back and looked at non-metallic insulation debris assessments.

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On top of the final report for APR1400, which I discussed, we also had two separate reports on the APR. One is the long-term core cooling for APR1400. You probably all are aware that based on a Commission requirement we are required to comment on and report on the ability of any of the new designs to be able to maintain long-term core cooling for an extended period of time, given a range of accidents. And so this is our report to you on their ability for APR1400.

The second report is the safety evaluation for a topical report. Again, an APR1400 case, as it is for a lot of the advanced reactors, there is a separate topical report on the ability of the design and the methodology associated with it to deal with loss of coolant design basis accidents. And so this is essentially our report to you on what APR1400 technology and methodology is for large-break loss of coolant accidents.

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The next report -- letter report to you is over two topicals. Part of the NuScale effort is NuScale has taken an active approach where they

have provided a number of topical reports in advance of their design certification application on a lot of the technical aspects that they like the staff to review and comment on and then we review.

This letter report is on two. One is on TR-48793, which is nuclear analysis codes and methods qualification; and on a second report, NuScale's power critical heat flux correlations. So both of these are topical reports that discuss their methodology on how they will handle their codes and methods for qualification under steady-state operation, as well as their data and associated modeling for critical heat flux correlations.

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Another report which we provided to you is the Brunswick Steam Electric Plant's maximum extended load line limit analysis plus, or lovingly referred to as MELLLA+, for license amendment requests. And Brunswick was changing from their current fuel to a Framatome fuel, and they wanted to apply the MELLLA+ framework to that. And so we took it upon ourselves, because this was a unique application of MELLLA+, to review and comment on to you.

The second one is the interim letter on Chapters 7 and 8 of the NuScale design certification application. This is the first of many that will be coming to you over the next year where we looked at Chapters 7 and 8 and issued an interim letter. The only reason I bring this up is that Chapter 8 had a major open item, which is still -- the staff is comparing Chapter 8's design certification and that design to the topical report, which talked about the use of non-Class 1E power to provide needed emergency power.

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Continuing with my discussion about topical reports, we also looked at from NuScale the topical report Rev 1 of subchannel analysis methodology. This is their approach to dealing with not only steady-state but also transient analyses for NuScale using their subchannel tools.

And then, finally, we had two license renewals. One that is shown on this page is our review of the license renewal for the Waterford Steam Electric Station Unit 3, and on the next slide the report on River Bend and their license renewal, which we thought were both appropriate for moving forward.

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So ongoing and future reviews. This is what kind of is looked at in the future. First, the design certification for NuScale. As I mentioned, we have looked at Chapters 7 and 8. We have a list of things which we are going to be looking at in terms of various chapters over this next year. And the only thing I wanted to emphasize here is we are working with the staff on scheduling. It is very important that we work closely with the staff to make sure that we understand what they are doing, and we have an appropriate time for a timely review of what they are proposing or presenting to us, whether it be closed or with open items.

This month, for our full committee meeting, we will be taking up the next two items. One is the early site permit for Clinch River; and, secondly, the license renewal for Seabrook.

The fourth item on this list is the Browns Ferry Unit 1, 2, and 3. We have scheduled a subcommittee meeting early in '19 to try to get a status from the staff of where they sit with their analysis for MELLLA+ for

Browns Ferry 1, 2, and 3, and also their analysis of techniques. They are doing some audit calculations we wanted to hear about. Whether we proceed with a letter report or not will be dependent upon what we find out in the subcommittee.

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And then we have a series of ongoing reviews for guidance documents and bases. I have listed three here. One is the draft Reg Guide DG-1327 for reactivity-initiated accidents. There is a revision of the Reg Guide on how to essentially do analysis for RIA events, and we are in the middle of reviewing that in this next -- early part of '19.

Second is the NUREG-2224 on high burn-up fuel storage and transportation. And the third is NUREG-BR-0058. This one we -- we did issue a letter report on. Staff, in their phase 1, wanted to come back to us after they had public comments and finish their phase 1, and that is planned for early in '19.

Final topic in this area is the licensing modernization framework. This is part -- and the final part of the staff efforts to provide an alternative pathway for advanced reactor applicants. It is a risk-informed pathway which is being made available for non-light water reactor usage.

We had a subcommittee meeting on it. We plan to take this up in full committee in February.

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In terms of digital I&C, we continue to monitor the integrated action plan, as I noted is our -- part of our continuing effort to work with the staff on that. And then in terms of rulemaking, we are going to be coming

back and talking about the rule for the non-power production or utilization facility, or, again, known as NPPUF.

This is interesting because when the ACRS did review this, provided a letter, the rule went out for public comments, some of the public comments that came back were quite interesting. Staff took it upon themselves to actually modify the rule based on public comments to change from a power-related demarcation to essentially a dose-related demarcation. And so we will be taking this up in February as part of the NPPUF revised rule.

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And then of course we have to talk about thermal hydraulics or it wouldn't be a fun meeting. So we have a couple of topics. One is GSI-191. The PWR Owners Group is planning to come back to us to talk about in-vessel debris testing and their test results. Framatome will be coming back to us, and their final topical on AURORA-B, which is their transient code suite, particularly applied to how they are going to deal with AURORA-B for LOCA analysis; and then, also, RAMONA5, which is a methodology for -- a revised methodology for anticipated transients without scram.

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Following on, Westinghouse will be coming back to us in the spring with their critical power correlation for the Optima3 fuel, and then also they have a new methodology for subcritical reactivity measurements that we'll take up in the spring. These are topicals that we have worked with staff on reviewing.

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In the area of reliability and PRA, we continue to monitor the

Level 3 PRA. We have a continual discussion with the staff. They come back to us as they have progress, and we monitor what is going on in terms of the PRA results for Level 3 with Plant Vogtle, and a human reliability analysis, the IDHEAS program, and their work in control room abandonment risk.

And that is kind of what we have done and where we think we're going, and I'll turn it over to Member Bley.

MR. BLEY: Thank you. I am going to talk about the draft proposed rule for small modular reactors and other new technologies, becoming known as ONTs.

My next five slides are kind of a brief summary of the history of how we got to this point. The first one on this list, 10-0034, identified key issues for SMRs, and the staff raised the points that these designs are unique and varied. They are smaller and generally passive, and the one-size-fits-all approach to emergency preparedness might not be appropriate for them.

There were a series of SECYs that led down to the last one, which -- where they proposed going ahead with the rulemaking on this area.

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There were a series of reports issued, both from committees and from the staff, on emergency preparedness and siting issues that date back to when commercial power reactors first began. The first one on this list, WASH-3, looked at what kind of exclusion area you need for an uncontrolled release and came up with a little formula of the radius of the exclusion area in miles and the power in kilowatts thermal.

As we began to look at more practical and larger reactors

sited closer to population enters for providing power, it became apparent this exclusion area wasn't going to work. So the emphasis shifted from isolation more to containment.

Down at the bottom, TID-14844 was really the seminal work in siting that has led most efforts up until close to the current time.

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This is a series of reports and regulations on source terms and siting. WASH-1400 is up here, the first PRA, because that's the first time that people tried to calculate source terms for particular accidents or groups of accidents.

The next one, NUREG-0396, has really been key to moving forward and up to the current time in the planning basis, and it was issued before TMI going out but several years after WASH-1400, and it used information from WASH-1400 and tried to generalize it to set up a logical approach for siting. And that is used for the current rules, and probably something like it will continue for a long time.

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ACRS has been involved in this source term siting issue, again, since the beginning of NRC regulation in this area. And the 1950 WASH-3 report, which I mentioned earlier, was written by our predecessor committee before two committees were joined to form ACRS.

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In recent years, we have issued several reports that are really germane to the current work. The 2007 and '13 reports on what was originally called the technology-neutral framework -- it was NUREG -- issued

as NUREG-1860, and a few years later the NGNP licensing issue White Papers, continued a methodology that was introduced by the MHTGR application some years before this, refined it, and applied it in new ways, and has led to the newest version of this, which is the licensing modernization project.

And I will take an aside. We were supposed to have a full committee meeting on that this month and write a letter. Losing a day, that one has dropped off, and we won't get a letter to you until February. The other ones that were on our schedule were really key for licensing decisions, so they took precedence.

The last three reports here are kind of in the last year, and looking at the staff's effort to developing vision and strategy for moving forward, principal design criteria, and, finally, the functional containment work that is before the Commission right now. In the principal design criteria review by us, we noted an inconsistent definition of containment. The staff agreed and tell us that that will get resolved after the Commission deals with the functional containment SECY.

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We are now to the proposed rule. We find that the proposed rule really replicates most of what is in 10 CFR 50.47, C2, and Appendix E to 10 CFR 50, and 10 CFR 50.33(g), with two significant changes. It reorganizes the emergency plan requirements, and it develops alternative EPZ requirements.

As far as the emergency plan requirements, they have been organized into a more logical order, suggesting priorities, and applying the

lessons learned using the existing rule. And they have developed performance-based requirements instead of what was done in the past.

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The EPZ requirements were really the main purpose I think of the new rule to allow the smaller plants to have different EPZs. The current plume and expansion -- plume exposure pathway emergency planning zone is generally 10 miles, and the ingestion pathway is generally 50 miles.

The proposed rule develops a performance-based criteria of a plume exposure pathway of dose of less than 1 rem. And as before, the purpose is to provide areas where predetermined protective actions can be carried out the following event.

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The proposed rule EPZ requirements, continuing, the applicant would have to consider plume exposure doses from a spectrum of credible accidents for the facility. This is the so-called mechanistic source term issue.

The rule would allow SMR and ONT applications to develop reduced EPZ sizes commensurate with their hazard.

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We also reviewed the guidance written to support this rule. We found that the guidance for preparing emergency plans is most of the guidance document, and we found it very thorough and easy to follow. On the other hand, the guidance for using the new alternative EPZ is a little different. But we think the key to defending a smaller EPZ size is, in fact, the source term, and that's the fission product releases and characteristics for a

whole spectrum of accidents.

The guidance for determining the release scenarios and source terms is pretty sparse in the guidance document. It has an appendix that purports to tell you how to determine EPZ size, but, again, it is very sparse on the source term work.

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We think developing the mechanistic source term for each element in the spectrum is really not an easy task. It involves complex physics and chemistry, chemical phenomena, especially including the evolution and transport of aerosols.

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Our recommendations and findings are pretty short. We first found there is no technical obstacle to the rulemaking. We recommend that the rulemaking move forward. Second, we think the staff should provide guidance to define their expectations for the technical adequacy of the mechanistic source term or applicants may be left kind of swinging in the wind when they send in their design-specific applications.

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We had a comment in our report that as we reviewed both the rule and the guidance, we found no stated technical basis for restricting the new rule to SMRs and ONTs with specific power limits. The logic that developed seemed to apply equally for all kinds of reactors. When we quizzed the staff a bit about this, they really came forward with no real technical basis for that limitation.

We have been told that the staff is going to request or

suggesting to request stakeholder input on this particular topic. At this point, while I was going to say we have not received the staff response to that letter, I was notified 20 minutes ago that it showed up. So the committee has not reviewed it, and we have no -- nothing to say about it right now.

MR. CORRADINI: So we will carry on. Member Brown.

MR. BROWN: Okay. I am going to talk about the draft digital instrumentation and control interim staff guidance, ISG-06, licensing process, Revision 2.

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A little background. This ISG defines the licensing process for review of license amendment requests for safety-related digital I&C modifications in operating plants and new plants once they become operational. It provides the industry with guidance for pre-license amendment request activities, as well as the LAR review process itself. Revision 1 was issued in 2011.

This effort was largely undertaken back in those days to provide a single document that gave us a pathway for the development of digital I&C modifications to plants for LARs. That initial version consisted of -- provided three specific tiers under which the reviews would be done.

One was a -- Tier 1 was when the applicant was using an approved computing platform, in other words a computing box that NRC had provided a generic approval for. Tier 2 was for approved computing platforms where they were using an approved platform, but they were applying deviations to it. And Tier 3 was for new platforms where no generic approval was available, so there was a more extensive review of the platform itself

involved. Each of the tiers had four phases.

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Some differences between Revision 1 and Revision 2. Revision 2 incorporated lessons learned and industry feedback. One of those principal additions was we -- we added the focus on fundamental design principles, which the committee and the staff has been emphasizing over the last few years in the applications and modifications.

Those design principles are redundancy, independence, deterministic processing, diversity in defense-in-depth, and control of access. What we mean by "deterministic processing," which may not be obvious, is when you start off with a signal going in, it goes out the same way every time in a repeatable and predictable manner.

ISG Rev 1 was used in the Diablo Canyon protection system review, Hope Creek power range monitoring systems, and a number of digital I&C topical reports.

Some lessons learned were that the tiers and phases were useful. We also found -- one of the downsides was Revision 1 focused more on specific documents rather than the information needed to make regulatory findings. Also, the industry identified that there were significant resource needed to comply and move through this process.

As part of that review, they then -- we determined that the tiers and phases were maintained. They were useful. But the significant stuff was that these sections were reorganized, and the review processes were streamlined to reduce the docketed materials, which is obviously a useful endeavor, and it increased the focus on information needed to make a safety

determination.

A quantitative idea is that the original revision had 135 pages and Rev 2 has 75 to 80. It's not -- that's where the draft is. I suspect it won't change a whole lot.

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Another significant change to the -- in Revision 2 was they identified an alternate review process, and this is a pretty big deviation from the previous stuff. In other words, you could get now an approval of your LAR prior to completing all of the detailed design implementation and/or factory acceptance testing as well.

So this ISG now provides the guidance to walk your way through that alternate process, and it is issued after the system design; in other words, the big picture system design, not necessarily all the nuts and bolts that go into an implementation and detailed design. That also requires the use of an approved NRC topical report for a computing platform.

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Our observations in the letter we wrote back, the report, was that the ISG largely focuses on software development and is silent on hardware and hardware configuration control and management. It also did not really address any interaction or the importance of interactions between the applicant and the ownership of the system once it is being installed. So those items are being taken care of in some changes.

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Other observations with the -- we make is staff did ensure that four of the five fundamental design principles are addressed in the ISG.

We remain concerned that the fifth critical fundamental design principle for architecture design of I&C applications, control of access, is not included in the ISG.

Other observations, we noted that the design approaches and administrative controls to restrict internal plant access to systems are used. That is consistent with prior projects. That is no real difference there. But control of access also means preventing remote electronic access to in-plant systems and networks from sources external to the plant.

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To ensure remote access is prevented, plant and system data transmission should be configured to be one way, from in-plant to external recipients using only hardware-based processes, which are not configured by software. That was part of the discussion in our letter report.

Our letter report then urged the staff to formally incorporate this principle into the licensing design evaluation process.

Conclusions and recommendations in the letter. The draft ISG-06 should be issued for public comment, provide the draft final I&C Revision 2 for our review following resolution of public comments, and address the configuration management concern before final publication.

In the EDO -- the directorate response to our letter, they were satisfactory regarding the specific recommendations in the July 18th ACRS letter. However, the revised ISG did not address our concern regarding the fifth fundamental design principle of control of access. It was not discussed.

That is a continuing concern, so we provided a response to

the EDO on their response on November 8th and requested that they provide the basis for not explicitly addressing the control of access critical fundamental design principle for the architecture design of I&C systems or any other revision that would help ensure prevention of remote access -- electronic access from sources external to the plant. And we will continue to follow this concern.

I'm done.

MR. CORRADINI: Thank you, Charlie.

Ron? Member Ballinger.

MR. BALLINGER: Yes, sir. Good morning. I'm going to have a brief -- talk briefly about the safety aspects of the APR1400 PWR. Chairman Corradini has mentioned it in his introduction, so with a preface to that, we issued the final letter on the design certification in July. Previously, we had -- we had issued four interim letter reports, and I have actually forgotten the number of subcommittee and full committee meetings related to this. If I had to read it, it would probably take half an hour.

We had four topical reports, and, again, the long-term core cooling -- core cooling report. To bring us a little bit up to date on the design itself, it is based on a CE System 80+ with some enhancements, among which is an innovative ECCS fluidic device. If you don't know what a fluidic device is, the next time you flush a toilet, look and you will see what a fluidic device is, and in-vessel retention as an option.

Instrumentation and control is a Common Q platform, and they used extensively PRA for design decisions. But a conclusion of all of our review was that the APR1400 design is mature and robust, and that there

is a reasonable assurance that it can be constructed and operated without undue risk to the health and safety of the public.

Having said that, there are some lessons that we -- lessons learned, and you can read this as being a little bit critical, but I do not mean that at all. It is essential that the staff and applicant be supportive and responsive in their interactions with the ACRS, and this was exactly what happened. Very, very closely coupled. Remember, there was a 42-month commitment on the part of the -- part of us to get the review done in time, and it was very -- we were very, very tightly coupled, and that meant that scheduling flexibility was essential to successful and timely review.

We were running before the flames, and it was -- it was a tough road, but the staff -- both the staff as -- both the ACRS staff, as well as the NRC staff -- and I believe that we may have caused Bill Ward to retire early.

Thank you.

MR. CORRADINI: Thank you very much. I turn it over to you, Chairman.

CHAIRMAN SVINICKI: Thank you for those presentations. I will be recognized first for the Commission question and answer period here. Let me begin by thanking both the presenters and all of the committee members who participated in the work that was presented here today, including the letter reports that we received.

I reviewed or reviewed and reacquainted myself with the subject matter of each of those letter reports in advance of this meeting. I don't believe I have any questions that arise from any single letter report

because the committee continues to speak with commendable clarity to all of the issues.

I have my hypothesis about why the letter reports don't contain a lot of ambiguity. It is because you have a consensus writing process, and it is my experience that that often means that the subject matter to be included tends to be the agreed-upon items. Therefore, you can speak with clarity to that as a body, and things that can't -- the language can't be worked out tend to be maybe carried over to future discussions, or if deemed -- deemed not entirely essential to the letter report. So that's my hypothesis.

I'm getting a few small head nods and a lot of quizzical looks, but I also serve on a deliberative body, so I know about trying to work out language together.

That being said, I do think I have some topics I would explore. I know you speak through your letter report, so now I'm about to violate that by asking if the committee members have any observations on some things on which you have not written letter reports.

But it occurs to me that as the committee takes before it things like the licensing modernization framework, some of the continued issues related -- that were identified in 2010 as matters to be resolved for the licensing of small modular reactors, such as the EP letter report that you just wrote, that the committee has to grapple with, more generic matters. Something, again, like the EP work that you did wasn't necessarily for a specific SMR or specific type of reactor, so much so that the committee -- one the observations they offered was that the logic advanced for small modular reactors has potential applicability, really, to other reactors that are neither

small nor modular.

This is something that I think the Commission has at least taken on board and thought about. And, yes, you are correct; it's my understanding the staff will seek public comment on that notion. But it occurs to me, having served on the Commission when we identified the SMR issues to be resolved in 2010, that -- well, a couple of things occur to me. One is that it's 2018, and a lot of them aren't resolved.

So one of the things I was going to ask about on this, but maybe broader to licensing modernization framework and other things that the committee will have in front of it is kind of, what are the paradigms through which you will deliberate some of that as a committee?

In some cases, is it likely that you will just stay apprised of the staff's work and not necessarily have a letter report? It struck me that your intention on something like the licensing modernization framework was to perhaps advance perspectives in a letter report.

But some of the staff's approaches are conceptual. I think what I'm grappling with is when we look across the work you do, some of it has great specificity, and the letter reports that reflect that are very technical and look at staff's methods and various calculational approaches and computer models. Others I think that I'm asking about are going to be -- and still -- the agency's work will still be at a theoretical and conceptual level.

How does the committee navigate that? And I note you referred to an ACRS -- your predecessors in 1950 had a report on source term issues. So, obviously, the committee searches its archives for times when your predecessors of long ago had to grapple with things that were more novel

in the nuclear enterprise than they are today.

Are there any insights of your predecessors that you think you bring forward into considering new paradigms for modernizing our licensing framework or the -- I was going to say the advanced reactors, but the truth is, if you search your archives for what we consider advanced reactors in the U.S., you probably have letter reports from decades ago on the exact same technology because it's a poorly kept secret that the advanced reactors were pursued with more vigor in this country and other places in the '60s and '70s, but they are new to us I guess, so we will continue to call them advanced and new reactor types.

But that was kind of just a broad concept, and I would invite, if there are members of the committee present who want to approach the microphone, but it looks like Member Bley is going to step into the --

MR. CORRADINI: We are going to assign --

CHAIRMAN SVINICKI: Okay.

MR. CORRADINI: We are going to assign this one.

MR. BLEY: I have been signaled.

CHAIRMAN SVINICKI: Okay. Thank you.

MR. BLEY: Interesting questions, and I'm trying to sort them out in my head. But we'll be writing our letter on the licensing modernization project in a few months, and -- well, we already started because we were expecting to issue it this month.

Now I'm just speaking for myself. I think there we will dig in pretty deeply. One of the things I note -- and this is just me -- is that I mentioned there has been this evolution of this general approach from the

MHTGR up through the present time, and I think the one thing -- one of the things the new approach is doing is they have operationalized, if I can use a dreadful word, how to examine defense-in-depth.

And I think the other approaches included defense-in-depth, but didn't really tell you how to do it, and I think this new one has made that something that people can apply. Now, we are going to want to see real applications of it and see how it works.

CHAIRMAN SVINICKI: Can I ask, what would be the general approach of what you are comparing it against, though? Are you comparing it against, is it workable? Or is it complete? Or, you know, how does it compare to what we do now? I just -- I don't know what paradigm one begins with when looking at a truly modernized process.

MR. BLEY: Well, I think it would be all the things you mentioned.

CHAIRMAN SVINICKI: Okay.

MR. BLEY: But, you know, people have struggled with trying to define defense-in-depth for a long time. And if you don't define it, it gets kind of out of hand. It just grows. Well, I want to add this because, man, this is defense-in-depth -- and we -- the archives are good. We had a paper that really set up to address this some years ago.

MR. CORRADINI: Early 2000s. You're talking the structuralist versus the rationalist paper?

MR. BLEY: Structuralist and rationalist thing. And Dana and George Apostolakis were the lead authors on that. And that tried to say -- how do you play these against each other? The rationalist would use a risk

assessment and only do those things that really matter to risk. The structuralist would put barriers of some sort there.

The rationalist would say, "Well, your barriers don't work for this scenario." The structuralist would say, "Well, your PRA is missing some things or it hasn't thought about the uncertainty." So you have to kind of play these against each other. And we haven't written our response to what is in the guidance now, and that's linked to an NEI report that was developed by this licensing modernization project that the staff followed very closely.

But we will certainly want to look at how they suggest doing that balance, and I think they have come up with some pretty good ideas.

The other thing on the history, one of our staff members, Hossein Nourbakhsh, was kind of chartered to go back and dig. And he has put together -- he has pretty much read all of the reports back to the originals, and we have copies of all of them, and reorganized them. There is a paper coming out soon I think by him that will be a conference paper or a submitted paper.

I have looked at a lot of what he has put together, and it is really interesting. And we do go back, and now with that work, it's easier to go find what you're looking for because those older papers weren't very well --

CHAIRMAN SVINICKI: Indexed or --

MR. BLEY: There was no index to them. Yeah. They could just say they go read a bunch of papers. So now we have kind of a history of what we have been involved in over the years, how that shifted, and what kind of reports we did, so it can focus you back pretty quickly.

So on functional containment, that letter report had a lot of that history that related to containment. We dug out a bunch of it and recorded what we could. We try to do that, so we -- we do look at the past.

And the name jumped in my head as you were talking about modern reactors, or whatever the term was. If you still have a copy of Etherington's Handbook, all of these designs are there.

CHAIRMAN SVINICKI: But, of course, those insights from your predecessors have to be pushed through the sieve of all that has occurred since then, and the United States now has thousands of reactor operating years of experience. The computational tools are probably beyond the comprehension of those who were grappling with these things with slide rules and other devices. So the committee, I imagine, has to take that on board when looking at those insights.

MR. CORRADINI: Yeah. I was going to just add one thing to Dennis. I agree with what you're saying. The one thing I guess that -- and, again, we will find this out when we talk about it. We have had the subcommittee. So in the subcommittee, the one thing that impressed me is the various industries, the various vendors or potential designers are talking to each other.

So they are talking with the staff in terms of the LMP. They are talking to each other. So they are getting a clear picture of how they have to go through the process. And to me, that's a very important part of it is that there is this common discussion.

So to get back to I think your starting point where you said, "What's the paradigm?" or "What's the comparison point?" they are doing kind

of an intercomparison with their -- even though they are different designs, they are trying to see what has to be there, so that they can properly address the issue. And to me, that's a very important point.

MR. BLEY: Let me sneak in one other thing I meant to say and didn't. One of the things I've noted in the documents supporting this licensing modernization effort is that where previous renditions of this, especially 1860 and the NGNP, kind of made it sound like the basic framework covered everything that you worry about in licensing, the new work has really identified that there are certain -- I think there are three different areas where it needs to be applied, but that the rest -- other parts of regulation exist separate from that.

So it's not a simple fix takes care of everything. It's, really, key issues get decided through that, but there are other issues.

CHAIRMAN SVINICKI: Okay. Thank you. And just with the indulgence of my colleagues, just a more logistical question. Another area of some novel work may be the accident tolerant fuel development. Does the committee view that it has enough awareness of matters coming before the NRC and the general timelines for that, that they are able to plan out their meeting schedule and work for -- over the coming 12 months? Do you think you have sufficient clarity?

MR. CORRADINI: I think the quick answer is yes. We had a subcommittee meeting in mid-November where we actually brought in the NRO, NRR staff, as well as industry, to see, a) what they are proposing; and b) what is the staff thinking in terms of how it fits together. So it was in the context of modeling and the advance models. But we learned a lot about

the ATF projects and how certain things are short term and will be dealt with in the -- I'll call it the early next couple of years versus the long-term concepts, so yes.

CHAIRMAN SVINICKI: All right. Thank you very much. Thank you.

Commissioner Baran.

COMMISSIONER BARAN: Thanks. Thanks for your presentations. I also want to start by asking about a topic that you didn't present on today, which is the post-Fukushima mitigating beyond design basis events rulemaking.

The Commission has been considering the draft final rule for some time, and I know that ACRS previously did some work examining the rule. I see the core of the draft final rule as the requirement for licensees to develop and maintain mitigating strategies for beyond design basis events based on the modern reevaluated flooding and seismic hazards.

I think it's essential to require the FLEX equipment at nuclear power plants to be reasonably protected from the up-to-date flooding and earthquake hazards. I would be interested to hear what you think, though, about that safety issue. Do you have individual thoughts about the importance of this aspect of the draft final rule that you'd like to share?

MR. CORRADINI: Okay. So that one is coming -- a bit different topic. So I'll start off with I think we issued letters on the draft final rule in November of '15, and then again in December of '16. I think we came back to you with some suggestions, which you politely told us "no," in February of '17, which is fine, but I think those are the three letters.

And so from those, I think our letter reports speak for themselves on a consensus basis that we thought the rule was -- with some modifications was appropriate.

COMMISSIONER BARAN: And with respect to that --

MR. CORRADINI: But that's -- I'm answering it based on --

COMMISSIONER BARAN: Sure.

MR. CORRADINI: Okay.

COMMISSIONER BARAN: With respect to that aspect of it, in terms of having the FLEX equipment protected against the updated flooding and earthquake hazards, when you all looked at that with your letters, you thought that made sense.

MR. CORRADINI: I'm going to turn to -- he is the -- he is the descendant of a former member who worried about this, so --

MR. BLEY: And who wrote much of what we said in this area, at least the first drafts of it. I've been refreshed a little bit because we have one remaining meeting with staff, and we have had conversations with them recently. There was a methodology proposed by industry and the staff on how to evaluate plants against the reassessed seismic and flood hazard.

It looked pretty useful, and we had one negative comment on it. But we did ask that when people actually apply it, and submit their analyses, that the staff come back and show us a variety of those. And we have on the -- not quite on the calendar but we have expectations that they are going to do that for one of the two issues in the spring, and for the other one in the fall. They have received analyses from licensees.

I guess the only other thing I would say is, you know, we followed this a lot. We went out to visit the places where the FLEX equipment is stored, saw how they did it. We talked a lot with industry and the staff. We had a closed meeting with industry where they came in and did essentially a drill, but a walkthrough, and laid out all of their -- all of the procedures of all sorts, because we had commented that the procedures aren't well integrated. And they showed how this whole process and developing the strategies all tied together and how they put it together.

And this is personal feeling -- from what they showed us, I think if we have -- when we have the next surprise, that will be invaluable to them. We only saw it for the BWR, haven't seen the PWR.

COMMISSIONER BARAN: Integrated response capability you're talking about.

MR. CORRADINI: And the only other -- since this has been a couple of years ago, the only other thing is when we visited Limerick, as we tend to do in July, we try to visit a region and a plant. We visited Limerick, and we -- they gave us a quite extensive tour of their FLEX facilities and how they have put it together, so --

COMMISSIONER BARAN: Well, let me ask a few questions, then, about some of the topics you did present on today. Dennis, for the draft proposed rule on emergency preparedness for small modular reactors and non-light water reactors, you discussed how important the agency guidance on source terms will be. What do you think the staff needs to do on the guidance, and how challenging do you think it will be to do it?

MR. BLEY: It's going to be fairly significant, and I would

say we have -- we have had meetings with the folks who have been developing these new fancy codes for DOE. And when you come down to the end and you start looking at what really matters, yeah, they haven't gotten to that part yet.

So nobody has really done much here for a while. There have been experiments. So I don't know how much work it is going to be. I think there are probably interim steps where the process can be simplified, and somebody has got to work on that. I mean, if we leave it up to the applicant to do that, it's going to be all over the board, I expect, and then staff will say, "No, that's not what we want."

So I think it's -- there has got to be some clarity, so people know what to do.

MR. CORRADINI: I would just join in and say that Reg Guide 1.183 gives the alternative source term currently. But one of the preliminaries in the reg guide, if you -- if you've read it -- is they identify six attributes that if the licensee -- if the applicant says, "No, we don't want to do that source term, we want to propose this," you know, it leaves me six qualitative attributes. And I think that's actually pretty good guidance.

And so in the discussion with staff, they actually reminded us -- I didn't realize, so I went back and read it. But I think something like that to give the applicant some guidance, so they're not shooting in the dark.

COMMISSIONER BARAN: Charlie, for digital instrumentation and control, you talked about the ACRS recommendation on the fundamental design principle of control of access. This is the recommendation that plant and data -- plant and system data transmission

should be one way, only leaving the plant, using only hardware-based processes that are not configured by software.

Do you see this as essentially a cybersecurity issue? And how do you see the relationship between the staff's digital instrumentation and control work and the NRC's cybersecurity standards?

MR. BROWN: I would like to answer that one. It depends on how much time you want to take. Don't worry, I won't --

MR. CORRADINI: Very brief.

MR. BROWN: It will not be brief. Yes, it will be brief. That has been contentious to a certain extent. To try to provide an illustration of what the problem or what the issue is, I wish I had a figure, but I'll give you -- if you can picture in your brain three boxes, two of those boxes have a dotted line around them, and those are in-plant, within the plant itself.

Outside that box there is another box called a network, which is in the site somewhere, wherever it is. It's that output from in-plant to that site network that -- where the issue resides.

This is a personal opinion now. Okay. We have argued -- in our letters, we have argued that that point ought to be a hardware, not configured by software, because you don't want to allow anybody to get through that boundary. The plant -- the site network is obviously going to be communicating with everybody all over the world.

So how does that network communicate backwards? You don't want it to communicate backwards. That is a -- you create a super highway for somebody to come in, take the in-plant network, and they could take over control of everything, all your pumps, they could -- they could modify

the signals going to your main control room.

Some of that may be restricted, depending on the configuration. If you add another box, which is the reactor trip and safeguards, if those are truly isolated from the in-plant network, you could -- some would argue that, gee, as long as those are protected, you don't care what happens to anything else, and the protection system will take care of you.

I have a little bit of difficulty with that much of an allowance. If you look at the cybersecurity rule, which is 73.54, it is an oversight program. It is not a design program to any extent. And one of the last -- I've forgotten which alphabet soup it is at the end, it's like Section H under some number section says you don't even have to get NRC approval for what you're doing. You just develop your plan and your processes, and it can be audited, and we can ask about it.

When I first got here in 2008, and we looked at one of the first plants, even architectures were not even included in the presentation we made at the first subcommittee I was at in June of 2008. It was a half a dozen boxes, it said, and then quoting a whole bunch of reg guides and standards and said, "Trust us. We'll design the thing to make it work right."

And we insisted at that point to start providing a detailed architecture from which the body of the members of the ACRS could understand the overall architecture of the I&C systems in the plant. And as we have moved forward, every applicant and every system has been designed with that architecture in mind. Where we're discussing it now is not in a specific applicant's LAR but in an ISG that says now what goes forward to tell

people what they have to look at.

Frankly, if I'm still here and we get an application, this ISG is for all operating plants and anything new that becomes operational. If I'm here, I will obviously bring this issue up. So far, applicants have complied. They have seen the light -- let's put it that way -- and have incorporated that one hardware-based output from that in-plant last communication point to the site networks.

Now, what happens in the future? I just think it -- our point here is it ought to be brought up in the design phase at that point, because you do not want that site -- that port opened all the time with some third party virus protection or cybersecurity guy constantly feeding information to update it. And I don't think that applicants are going to want the cost to have their own 10-person staff, which are constantly monitoring and updating that software.

Cybersecurity is largely reactive. You fix stuff after it has already hurt you, so it can't happen somewhere else. It is not proactive at stopping it, and the only way to keep people from getting in is to provide a door that can only be opened from the inside and is not even visible from the outside. So that's -- I don't know whether I answered your question or not. That's kind of my --

COMMISSIONER BARAN: That's very helpful.

MR. BROWN: That's largely where our letters have been focused.

MR. BLEY: I have just a short addition to that. You know, you asked about control of access versus cybersecurity. If you protect

against one, you protect against both, I think is the key answer. I think in some of our earlier letters we pointed out, when you do the detailed design analysis review, you are really getting into the guts of the system.

And, you know, that makes sense to do it at that time, whichever point of view you are coming from. And you don't want to just overlay it later, but control of access is really you are worried about accidental or other things getting into the system where cybersecurity -- you've got a foe out there trying to get in. But what you do to protect against it is the same, and where you can really see it in detail is in that design analysis.

MR. BROWN: Let me -- can I amplify that just a little bit?

MR. CORRADINI: Only a little bit.

MR. BROWN: Only a little bit. When this cyber program gets implemented, it's really at the COL stage for the most part, such that it could be four, five, six years after you have issued an LAR on the design certification documents. And since it is an oversight program, not a design-based, difficult to see how you're really going to get that protection enshrined four or five years later. It's a conundrum. We've got to work our way through it and come to a conclusion.

COMMISSIONER BARAN: Thank you very much. Thanks.

CHAIRMAN SVINICKI: Thank you, Commissioner Baran.

Commissioner Burns, please proceed.

COMMISSIONER BURNS: And just to follow up -- a couple on this. So I take it you -- there was a letter that went back to the staff, but you haven't gotten anything back from the staff at this point.

MR. BROWN: Are we on the control of access?

COMMISSIONER BURNS: Yes, sorry.

MR. BROWN: Our November 8th letter, we have not gotten a response. That's why --

COMMISSIONER BURNS: Okay.

MR. BROWN: -- I couldn't address it one way or the other.

COMMISSIONER BURNS: Okay.

MR. BROWN: A formal response. Let's put it that way.

COMMISSIONER BURNS: Yeah, yeah. And I guess, just to follow up on this topic, one other issue related to -- this is on I think the configuration control, you know, the applicant ownership issue that you mentioned. And I think the staff indicated that they had incorporated something into the ISG prior to the comments.

So I'm just -- I don't know if you all have views on that as yet, whether they tried to address the comment and --

MR. BROWN: Yeah. I reviewed the public comments, and I did see some revisions that addressed the ownership issue. I thought those were incorporated satisfactorily.

COMMISSIONER BURNS: Okay. Okay.

MR. BROWN: Again, we haven't seen the second round. We have -- I saw the first round. The first response that they did, I saw the revisions and they looked okay.

COMMISSIONER BURNS: Right. Okay. Yeah. Because obviously the process continues on.

Let me go back to some of the emergency planning. Again,

Dennis, I appreciate the trip down memory lane. That was great.

(Laughter.)

COMMISSIONER BURNS: I mean, it was great. I mean, WASH-3 is older than I am. It's just unusual in some of these things. But I think that's an extraordinarily important effort, having -- I've talked to Mike before, some research I've done, and digging back on some of that is just extraordinarily difficult. I mean, I know I had -- one of them I saw a -- not an ACRS, an AEC policy statement which was on a microfiche, and it was sideways, and, you know, I think I almost needed somebody who was in -- an expert in hieroglyphics to try to translate it into the thing.

But I do encourage, in terms of retaining that, and I -- I know I'd be interested in it when the paper -- that paper comes out, very interested in it, because it does have -- and I might have some. I have a copy of NUREG-396, you know, one of the things they threw on my desk when I started working here in 1978.

And then as we went into, you know, post-TMI and -- well, post-TMI really giving the push in terms of emergency planning. It was -- I think, you know, it was -- it was getting there, and then TMI really threw it over the -- threw it over the ledge in terms of -- so I look forward to that.

A couple -- maybe a couple of questions, and one of the things you noted is this -- in terms of developing the rule, and the context and the framework for it, is that it may have application outside of a small modular reactor or the non-light water reactor, so-called advanced reactor designs, to other, you know, existing designs.

So my question goes to -- is really, if the staff, after getting

public comment on this, decided it wanted to include the current operating reactors within the scope of the rule, did you all have any kind of thought about how difficult that might be?

MR. BLEY: I can give you a hint. NUREG-1860 -- I forget its final name, but it was the technology-neutral framework, they raised that issue and said, "Could you -- would this apply to" -- well, there was going to be an application to a pebble bed reactor, but that kind of -- the support evaporated. So they went back to an LWR and tried to apply it, and one of the appendices walks through that process.

So we're -- now, some of the -- when we talked with the staff -- now this is me talking, and it's not in our report. We talked about that and said, "Why don't -- you know, you could do an application to an LWR." Same thing with the -- the new one, the one we're not doing this month.

MR. CORRADINI: The LMP.

MR. BLEY: LMP. And they said, "Well, yeah, but you wouldn't want to add these requirements onto an existing reactor who already went through it." Well, yeah, but what about a new reactor? Hmm. Well, they said, "I don't know why not."

The rationale laid out in 0396 is kind of a little homespun now, and based on a very old study. But the general conclusions have held up well, and the process they went through thinking about it I think is well documented. That whole process doesn't have -- only peripherally comes up with the fixed 10- and 50-mile numbers because things dropped off by then said, "Ah, for almost all these different kinds of reactors, that is going to be okay."

But the logic to getting there would say if you have the information, there is no reason you couldn't set the EPC on a plant-specific basis. So I don't think it would be a killer. And if you were doing a large reactor, you always have the option to live with the 10 and 50.

MR. CORRADINI: If I might just --

COMMISSIONER BURNS: Yeah. Sure.

MR. CORRADINI: -- so there are three things happening simultaneously. One is the one that we're speaking about. One is Clinch River ESP, which is asking for a licensing amendment request, a license amendment -- or an exception, excuse me -- an exception with a smaller EPZ.

So that kind of feeds into what Dennis has said, and then of course there is NuScale, which is following along. So I think the first potential application, to kind of answer your question, would be the Clinch River that we are going to be looking at this week.

COMMISSIONER BURNS: Okay.

MR. CORRADINI: Today.

COMMISSIONER BURNS: Okay. Good. Thanks.

Ron, in terms of the APR1400, I actually visited the Barakah site earlier, not this month but last month, early in November, which is very interesting. It was actually -- the most interesting stuff was actually all of the ex-pats who were there, particularly some -- I met somebody who is like I think the chief project officer. I may get his title wrong, but essentially was there, you know, building Byron, Braidwood, and, you know, so you talk about everything new is -- or old is new again, some of that.

But they -- one of the things I actually took back from that is

the -- particularly the UAE regulator as well as the site people were very interested, and the fact that the standard design approval and the ACRS review had come out and come out favorably on that.

One of the questions I have is that during your process, given that you have the Shin-Kori-3 in Korea, the sister or older sister plant I guess for the Barakah units, was there -- how much in terms of the operating experience got fed into what you all were looking at, if at all? Was that -- did that become relevant or helpful at all? Or maybe it wasn't there at all?

MR. BALLINGER: I guess I don't think that much of the operating experience got fed into what we reviewed.

COMMISSIONER BURNS: Yeah.

MR. BALLINGER: So you may have a comment. I don't -- I don't think so.

COMMISSIONER BURNS: Okay. Okay.

MR. CORRADINI: The one aspect they did is they have this fluidic device, and they did full-scale testing. We were most interested in some of their full-scale testing, since it was -- it was one of the new features.

MR. BALLINGER: I might add, if you continue on from Barakah and get to Korea, and if you go and visit --

COMMISSIONER BURNS: Yeah. I've visited --

MR. BALLINGER: -- and see that facility for that fluidic device --

COMMISSIONER BURNS: Okay.

MR. BALLINGER: -- they did a full-scale test, and that was pretty impressive.

COMMISSIONER BURNS: Okay. Interesting. And I agree. I appreciate your comments in terms of the interactions with the staff and the applicant, and also the ACRS in terms of flexibility, all in order to try to honor that goal of the 42 -- the 42 months. So I appreciate the efforts that the committee did with respect to that.

So, Chair, that it's for me. Thanks.

CHAIRMAN SVINICKI: Thank you, Commissioner Burns.

Next we will hear from Commissioner Caputo. Please proceed.

COMMISSIONER CAPUTO: Good morning. Thank you for being here. I'm going to start out with a question. I think, as a new Commissioner, I am getting more acquainted with the nature of ACRS's reviews and information of the Commission. But I have -- I have one question I wasn't really clear from reviewing the charter. Can you talk to me a bit about whether the ACRS considers backfit or backfit policy when doing its reviews, or what the ACRS's role is there?

MR. CORRADINI: So I will try to that one. I think. So my quick answer is, the ACRS doesn't get involved in backfit. It's not really our role. We view it that our role occurs prior to that, and, therefore, we would render technical opinions on the completeness or the correctness of certain technical aspects, but we don't deal with backfit.

My best example, old example, historical example, is the spent fuel study. I guess at the time it was called the spent fuel scoping study. And the question was whether it was required after Fukushima to have expedited spent fuel transfer. And we reviewed the staff's analysis prior to

the Commission taking on whether it should be done and whether it fit within the backfit rule. But I would say no. The quick answer is no.

COMMISSIONER CAPUTO: Okay. So then, in looking at the list of topics that is on your to-do list, one of them is NUREG-BR-0058 --

MR. CORRADINI: Right.

COMMISSIONER CAPUTO: -- for regulatory analysis. Can just tell me the nature of your review of that issue?

MR. CORRADINI: So I may -- where is my lifeline? I may ask Member Ray to come up. But the quick answer is that we are looking at the technical guidance document that would be used for that, and the associated appendices. But once that is set, or to put it a different way, if 0058 currently is being used in any sort of benefit-cost calculation, we don't deal with the analysis. We might deal with the technical basis.

COMMISSIONER CAPUTO: Okay. All right.

MR. CORRADINI: Do you want to say any more?

(Laughter.)

MR. CORRADINI: He's happy.

COMMISSIONER CAPUTO: All right. Thank you.

So in reading through the functional containment letter that ACRS put together, it refers back to the structuralist/rationalist paper from 1999. So I went back. I read that paper, which I -- I found that very informative. I think it really helps me in terms of thinking about risk-informing, and particularly with transformation in mind and pursuit of, you know, risk-informed, performance-based regulation, and so on.

So I am going to read a quote from the letter. It's almost a

direct quote from the 1999 report. It says, "As more experience has been gained with the application of probabilistic risk assessment in the design and regulation of nuclear power plants, when PRA models can adequately treat most of the phenomena of interest, the role of defense-in-depth can and should be changed to one of supporting risk analyses. This transition would need to be supported by the development of subsidiary principles from which necessary and sufficient criteria could be derived."

So this is talking about -- in line with the paper, this is talking about how, while the regulatory framework may have been driven by a defense-in-depth philosophy, when PRA reaches a certain level of maturity, the role of defense-in-depth can become one that is more supportive in addressing uncertainties in the risk knowledge that we have rather than sort of an overlying philosophy.

So I think in looking at transformation and pursuit of risk-informing -- risk-informed decisions, are we there yet? How do we get there if we're not? And how will we know?

MR. BLEY: I wrote that letter. That's why Mike is looking at me.

COMMISSIONER CAPUTO: So it's your fault.

MR. BLEY: We're never going to be there, and that paper didn't suggest that the rationalist -- the PRA would take over everything. There is always play back and forth. The PRA has some gaps, it has uncertainties. From that way of thinking, the role of defense-in-depth is to provide extra confidence, especially in the areas where we have the greatest uncertainty.

You know, when the paper was written, we had come through a history of deterministic rules, and the structuralist approach being the dominant and the PRA just kind of helping out a little. And the idea was eventually that will shift. I think it has shifted already.

But we will always have that play, and we will -- we will have to have people who understand enough -- when we get there who understand enough about the risk analysis to understand where the holes are, where the gaps are, where the uncertainties are, so that we make sure we beef up defense-in-depth in those areas rather than others.

And you read this in the paper, I'm sure -- I don't remember perfectly -- but the structuralist view, I'm going to build three barriers, six barriers, whatever, and they have intrinsic value.

Well, once we started doing PRA and started thinking deeply about this, they don't have intrinsic value. They have a value given a particular scenario. For some scenarios, that barrier doesn't exist, or for other it's not as effective. So the barriers aren't perfect, and the variety of things that can go wrong is large, so that you want a mix of barriers such that you are minimizing your risk in the areas where you're most uncertain about things. So --

COMMISSIONER CAPUTO: But if we as an agency are truly going to pursue risk-informed regulation -- and the paper from 1999 concluded that the rationalist approach would ultimately provide the strongest theoretical foundation for risk-informed regulation.

So I guess the question that I get into, then, as knowledge in this area will constantly be developing, growing, refining our understanding,

do we ever reach that threshold where that balance does shift? How do we -- how do we -- if this is going to be the strongest foundation, how do we get there, I think, because one of the challenges that I look at now is how often do sites need to refine or renew their PRAs? Because as knowledge develops, if a PRA is adequate for a decision one year, is it still adequate for a decision seven or eight years later?

And how often are we going to be driving licensees to revise that information? Do we, in that context, ever really get to a situation we're viewing risk-informed regulation in the rationalist perspective?

MR. BLEY: I think we've moved substantially that way. And now this is just me speaking, you -- I'm trying to remember exactly what you said on this one.

The standard, the PRA standard, the ASME, and there are a set of standards for doing PRA, all of them tell you how to see if your PRA is appropriate for the application you're looking at. They walk you through the process.

Ten years from now when you do the same process, things may have changed in the plant. The PRA may have changed, but that process will be the same. You ask the same questions. So they are all evolving.

They also give guidance on how often you should update your PRA. And, mostly, it is when you have had substantial changes to the plant or there is a substantial change in the state of knowledge, either about processes or physics or the parameters that feed the models that are used there.

So I think that's one, as we move rationalist, you have to make sure you are keeping up with the current state of knowledge. And you also have to always have this covering the areas where it's not as complete with some kind of defense-in-depth.

And I think that's the place -- and we haven't written our letter yet, and we haven't even had our final meeting on the LMP, but that's the place where they have done more work than anybody in the past on saying how you organize your thinking in those areas -- and we haven't talked about it as a committee yet, and written a report, but I think it has moved us to a point where if -- if we buy into that, it gives us kind of a road map for how you play those two against each other.

COMMISSIONER CAPUTO: Okay. Thank you. I just -- I found this paper and the nature of the thinking in the functional containment paper just really useful in terms of this issue, and certainly this represents a culture change I think for the -- for the industry and the agency. And so it's something I think I'll look at more as I go forward.

MR. CORRADINI: We haven't answered your question, so you don't have to accept our -- we have given you a progress report on the question. Because I think when we look at the LMP, we're asking staff and we had a number of the owner-operator vendors/designers in the room as they were doing it trying to understand.

So I think it's still to be answered, because you've asked a tough question. It's not an easy one to answer.

COMMISSIONER CAPUTO: Well, and to a certain extent, is it a question that can really only be answered if you are in design space

looking at future designs, and you handle it in that context? Versus plants that are already constructed and operational. Is it different?

So, thank you.

CHAIRMAN SVINICKI: Thank you, Commissioner Caputo.

We will next hear from Commissioner Wright. Please proceed.

COMMISSIONER WRIGHT: Thank you. Good morning. Before we get started, Dr. Ballinger, I can't wait to go to Home Depot this weekend and use the term "fluidic device." That's going to be a lot of fun.

(Laughter.)

MR. BALLINGER: It's very definitive.

COMMISSIONER WRIGHT: So thank you for your presentations, and it's good to see each of you. Happy Holidays, and I hope you and your family are blessed over the next few weeks and next year as well.

I'm going to go a little different direction, and then I might come back to the PRA discussion there for a second. You know, there has been considerable energy around in the agency here about transformation and innovation. And the staff has undertaken efforts to transform or modernize the agency's regulatory infrastructure, and they submitted a paper to us about it.

We have been briefed by the staff on it as well, and it's a topic that I believe is going to be very important to this agency going forward. And I'd like to get your views on a couple of things related to the modernization efforts.

And, I mean, Dr. Corradini, I could start with you, but anybody could chip in on this.

MR. CORRADINI: I had a feeling you might ask me that.

COMMISSIONER WRIGHT: So, and there is a lot of different questions. I'm just going to start, and then we can just -- we'll see where it goes from here. How does the committee view the NRC's transformation and innovation efforts right now?

MR. CORRADINI: Well, we -- myself and the Vice Chair and our Member-at-Large had a briefing on this. Now I'm trying to think. It was six months ago? Something of that order. So we're familiar with what the staff is suggesting to the Commission.

But I'm going to take this and take it a different direction. I think in some sense we ourselves have to look at our processes and potentially review them and see if we need to change them. I think -- I think one of the things that -- and we're going to -- we expect to do this.

We have a memo from you all about this, and -- but what I -- what we're planning to do is over the next couple of months have a retreat and kind of get back to you on it. But my personal view is that I think from the standpoint of personnel and process that we would like to enter into some of these things a little bit earlier into the process, so that we're not the last stop and hopefully not the short stop as a -- and viewed as a barrier.

So I think in some sense, if we're able to -- and I use -- the one example I guess I'd use about early and often to try to have a conversation with the staff about this, whether it be an applicant or a change in the regs, is what Dennis was talking about. To the benefit of -- to the credit of the staff,

they have talked to us a number of times about functional containment, emergency planning, and now the -- and early on, the advanced reactor criteria, and now the licensed modernization program.

And it's a theme where they are trying to educate us, so that we're clear where they're going. And I think the earlier we can be involved in the process, the better off it will be, so that we're not surprised. And if we have an issue, we bring it up early, right, and then -- so, for me, that's where transformation can -- what you call transformation, I'll call it just good management, should enter in.

The other thing is that I think we have sent -- I'll just say the former chairman has sent you guys a memo in terms of staffing, personnel staffing. And we see a need to potentially, just because of how our workload has changed, maybe change our size, okay? But still we need a broad set of expertise, too, that we can answer the questions.

So those are my two quick answers, but I am kind of focusing on us versus the staff. We heard from the staff. I think it was in -- this is kind of like a quiz, and I can't remember -- I know it was digital I&C, I know it was things related to more of a risk-informed approach, but there were a couple others that passed me by. I'm sorry, I can't remember.

COMMISSIONER WRIGHT: So, more particular, so the paper on transformation that talked that the agency's transformation should aim for more modern risk-informed approach to regulation, do you think that's the right direction for --

MR. CORRADINI: I do. I do. I think -- now, I have a bias, so personal opinion again. I am totally in favor that as long as I have

experimental data that I don't, with all due respect to the risk analysts, I don't do a calculation, I do a risk calculation, or I do a deterministic calculation. I don't have data to back it up.

So I'm, unfortunately, am empiricist by background, so I would tend to want to make sure that if I'm going with an advanced design, I have clear ideas of experiments that tell me what the source term is or what the bounds of the source term are, so that I'm clear about it.

But I'd say, save that, yeah, I think risk-informed approach is the way to go. I think we have seen a benefit there relative to some topical issues. The one that pops in my head is GSI-191, because I want to think it's -- South Texas has taken a risk-informed approach in terms of their GSI-191 approach, and I think that was a very appropriate way to do it.

In fact, I thought it was quite inventive, but that's a very particular example.

COMMISSIONER WRIGHT: Do you have any comment? Any follow-up?

MR. BLEY: Well, we, as a committee, haven't looked at the transformation paper. We did get an informal briefing back in -- must have been September, and some of the things, at least I was a little worried when I read words, when we talked about what they meant, it seemed pretty reasonable. So I -- I thought it was -- it seemed a reasonable approach and like it might yield something useful.

But, again, we haven't really discussed it or delved into it in great detail.

COMMISSIONER WRIGHT: Do you have any personal

thoughts about the -- expanding the systematic use of risk insights in the decision-making process? Do you see obstacles or, you know, would you have to change -- the committee have to change its view on the way it looks at things or --

MR. BLEY: I've been doing risk analysis stuff for 40 -- more than 40 years now, so I'm greatly in favor of it, but with the caveat that the people doing it don't just cookbook, that they think about the problems and identify the weak areas, identify the uncertainties thoroughly. So it has been used. I think it will be used more and more. But we need to use care as we go forward.

COMMISSIONER WRIGHT: I've got one last question. Go back to kind of the PRA. We touched on that just a second ago. So, and anybody can answer this here, but how -- how can the NRC and the industry further integrate risk insights into decision-making? And I guess, more importantly, do you see ways that the NRC and the industry could possibly use to standardize the use of some risk insights?

MR. BLEY: I think the process is underway, and I think these standards for PRA are helpful. I think there have been, over the last at least 30 years, probably 40, there have been more and more applications of risk-informed information into regulation.

I had something else, but I apologize, it has kind of slipped my head. If I get a chance later, I'll tell you.

COMMISSIONER WRIGHT: Okay. Well, I'm going to yield back. Thank you.

CHAIRMAN SVINICKI: Okay. Well, again, I thank all

members of the committee for their careful work and attention to the issues.

Do any of my colleagues have any additional questions? Hearing none, then we are adjourned. Thank you.

(Whereupon, the proceedings in the above-entitled matter went off the record at 11:29 a.m.)