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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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689TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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WEDNESDAY

OCTOBER 6, 2021

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The Advisory Committee met via Videoconference, at 2:00 p.m. EDT, Matthew W. Sunseri, Chairman, presiding.

COMMITTEE MEMBERS:

MATTHEW W. SUNSERI, Chairman

JOY L. REMPE, Vice Chairman

RONALD G. BALLINGER, Member

VICKI M. BIER, Member

DENNIS BLEY, Member

CHARLES H. BROWN, JR. Member

VESNA B. DIMITRIJEVIC, Member

GREGORY H. HALNON, Member

JOSE MARCH-LEUBA, Member

DAVID A. PETTI, Member

DESIGNATED FEDERAL OFFICIAL:

ZENA ABDULLAHI

P R O C E E D I N G S

(2:00 p.m.)

CHAIR SUNSESRI: Okay, it's 2 o'clock. We will reconvene the 689th ACRS Full Committee Meeting. I'll start with a roll call. And Ron Ballinger.

MEMBER BALLINGER: Here.

CHAIR SUNSESRI: Vicki Bier.

MEMBER BIER: Here.

CHAIR SUNSESRI: Dennis Bley.

MEMBER BLEY: Here.

CHAIR SUNSESRI: Charles Brown.

MEMBER BROWN: Here.

CHAIR SUNSESRI: Vesna Dimitrijevic.

MEMBER DIMITRIJEVIC: Here.

CHAIR SUNSESRI: Greg Halnon.

MEMBER HALNON: Here.

CHAIR SUNSESRI: Jose March-Leuba.

MEMBER MARCH-LEUBA: Here.

CHAIR SUNSESRI: Dave Petti.

MEMBER PETTI: Here.

CHAIR SUNSESRI: Joy Rempe.

MEMBER REMPE: Here.

CHAIR SUNSESRI: And myself. So we are going to continue with our agenda, starting at 2 o'clock here. We had the biannual review of NRC

Safety Research Program. And as the agenda is currently laid out, we have another topic starting at 4:15, which is really an, you know, unassigned topic. It's a clean-up -- It's clean-up time for finishing reports, preparation for the commission of presentation. And so what we may elect to do as we'll see when we get there, extend the biannual review to see how far we can progress this. We may get through it all in the allotted time. We may need some extra time. But the goal would be to get alignment of the committee so that the draft letter report can start being prepared. So that's where we are today. Just to let you know where we're going. Any questions about that?

Alright, well then I will turn to Vice Chair Rempe to lead us through this session. Joy, it's all yours.

MEMBER REMPE: Thank you. First, I want to thank everyone, not only the members, but also the research staff for participating in all the information briefings we've had. And I especially want to thank the three leads, which include Matt, Dave, and Vesna for their support in this effort, as well as the members. The Agency's research does span many fields. It's important that we are able to

benefit from the collective expertise of all of our members.

Today, if you'll go to the next slide, Hossein, we're going to go through a presentation that contains our initial thoughts about key points to include in our letter report. And we're currently planning that our letter report will have the six sections that are shown on this slide. Although as typical of all our letter reports, the conclusions and recommendations section will appear at the beginning of the letter, but this is the order we're going to go through our thoughts on what should be in each section.

And I'm going to start off with some quick -- with a quick overview of what will be in the background section of our letter report. And then we're going to have each of the leaders for the reviews of each of the research divisions to present their slides on what they have prepared. And then I'll go back through and propose some points for our integrated assessment and the basis for that integrated assessment will lead to the conclusions and recommendations.

I've emphasized to the leads, as well as I'd like to emphasize to the members that we're not

looking for any sort of a line by line type of comment. What we want to know is have we hit the high points of what should be included in the letter report? And where there are gaps, please notify us. And then we'll work on the wording as we go through this later on. Okay?

So let's go ahead and go to the next slide. Are there any questions or comments on what I've said so far? Okay, so in the background as in prior years, I'll start off with some high level remarks about what the Office of Regulatory Research does and how they accomplish their mission. And the words that you see here are typical of what we've had in prior letters. Okay?

And if you'll go to the next slide, Hossein. I'll include some historical information about the process that's used by ACRS to review research activities. And for those of you who've heard me say this before, it will sound repetitive, but because we have some new members, I will emphasize the fact that we do review the research program because there was an SRM issued back in 1997 that tells us to do this. And so those three items come from the SRM.

And then in addition over the years, we've

come to emphasize several other aspects such as are they able to not only meet current and near term agency needs? How well are they prioritizing new research projects, their long-term planning. And then how well they're responding to our prior recommendations.

And then in the next slide, I'll just talk about some of the process -- if you'll go to -- Yeah. Slide 5. We'll talk about the process and activities that we use to complete this report. And basically as you all know, we had the meeting with the Director of Research and then had three working group meetings where we listened to each division discuss the research. But then there are other briefings, some of which have already occurred and some which are planned in the future.

And actually in our conclusions and recommendations discussion, although I don't plan on putting those -- that list in the conclusions and recommendations, I have gone through the transcripts of each of our meetings and tried to list all the possible topics that we might want to hear about for some of our future updates, as well as we always do these episodic reviews like the IDHEAS Research Program on the Level 3 PRA.

But anyway, I would like -- if we had time today, to make sure that I did capture all the possible follow-on discussions we might want to have. And then we hopefully will get some insights on what the membership would look like with respect to priorities of those future discussions.

And so if there aren't any questions about what would be included in the background, I'll turn this over to Vesna who will start off with a discussion about the DRA overview. But I'd like to pause for a minute to make sure that members have an opportunity to provide their input. And hearing no additional comments, I'm going to turn it over to you, Vesna.

MEMBER DIMITRIJEVIC: Okay. So we're here to talk about the Division of Risk Analysis. So (audio interference) discuss the necessary -- I mean how I'm going to present that is just with our discussion today. It doesn't necessarily mean what we will be talking in our report or the letter. But it is the summary of relevant facts.

So it's a prominent agency resource in all risk-related matters. It maintains and enhances tools and matters for (indiscernible due to accent) evaluation, which supports the Agency's solution to

current and anticipated regulatory challenges. It's organized in four branches; the PRA Branch, Fire and External Hazard Branch, Performance and Reliability Branch, Human Factors and Reliability Branch.

How they define their main objectives is to grow the Agency risk informed decision making capabilities to be ready for future technologies, to complete high quality research products. And this is something that, you know, it sounds very general, but they have this new role in the Agency which we will discuss later. You know, of course, like everybody else, they want to facilitate transformation and build and enhance staff capability.

So the next slide -- Thank you -- The next slide, we will -- I'm talking about -- I mean it doesn't really have to be called highlights and observation, but I tried to summarize what are the plan -- what are the projects and plans for the future work in the different branches. So this is for the Performance and Reliability Branch. They're the one who -- you know, that maintains the PRA guidance and standards and same for the risk-informed decision making. And their future directions, you know, they have to plan to issue these new standards for the regulatory guidance. And we had actually today,

discussion on Reg Guide 1.247.

Their plan is to enhance guidance on the treatment of uncertainties. They're working with -- you know, on that, which is really positive because we will discuss -- I will discuss this later. Also they are -- They will offer guidance of risk-informed decision making and uses of non-PRA techniques. And they are developing two databases; one for PRA standards and one for PRA matters.

So throughout the efforts in the branch of Data Collection and Analytics, you know, they do the regular job of elevating -- operating experience information and also the (audio interference) is this accident sequence precursors, which I will like the operating experience from the Nuclear Plant, documents of uncorporational events.

Next slide is talking about -- The next slide is talking about the PRA Branch. They maintain two models; SAPHIRE AND SPAR. They plan -- Their future direction is to cloud-base SAPHIRE to do application of IDHEAS-ECA and to expand enhance (indiscernible due to accent) , you know.

And then we have a Level 3 PRA future directions. We are sort of familiar with the effort that they coming -- you know, causing to bend. But

they are -- So they are planning release of the reports. And they are planning to use Level 3 PRA to support licensing of advance reactors, which makes sense.

And then there is this new project, Dynamic PRA. And supposedly they will be documenting results, issuing final reports, and organizing workshop and training, you know, for this new work. And also seek and this work supports this changing environment.

MEMBER BLEY: Vesna?

MEMBER DIMITRIJEVIC: Next slide.

MEMBER BLEY: Can I sneak a question in?

MEMBER DIMITRIJEVIC: Sure. Sure. Whoever has a question, stop me in the middle. That's the best way to go through this.

MEMBER BLEY: The dynamic PRA, that's something Nathan Su has been pursuing for about 20 years or more.

MEMBER DIMITRIJEVIC: Right.

MEMBER BLEY: But he's gone now. Does this have a champion left on the staff?

MEMBER DIMITRIJEVIC: I don't know. I don't know, Dennis. I couldn't tell this. However, they did say that they're planning to, you know, do

this all work, you know, documenting these results, organizing workshop and training. So I assume there is somebody, you know, taking this over.

MEMBER BLEY: Okay.

(simultaneous speaking)

MEMBER DIMITRIJEVIC: -- talk a little bit more about that because they're also considering using this -- using this new -- you know, the non-PRA in the licensing of advanced reactor. (indiscernible due to accent) some function and bring some new insights.

Charlie had a question during the meeting about what is it actually the non-(indiscernible due to accent) PRA? And how does it differ from the regular PRA? And it differs by this time component, you know, how the -- Because in the PRA we can just go back to events in the old, but we don't consider timing dependency between them. So it's interesting that they will consider how can that be used to bring some insight. So for me, this isn't any new -- I don't know -- I don't think, Dennis, we have never had any presentation on it. Right?

MEMBER BLEY: Not since I've been on the committee. I've been following it for a long time and it was really impractical early on. Nathan wrote a paper a couple years ago, which I can find out if we

can share and pass it around. But he did mention once, I think a couple years ago to me that one of the new reactor folks was actually making some progress on an application. And it's possible because the design is pretty simple. So it will be interesting. And I'll see if I can get that paper --

(simultaneous speaking)

MEMBER REMPE: This is Joy and actually with questions like what you're raising, Dennis, I'm making a list and we'll follow up to find out a bit more about who's going to champion it since Nathan has retired and what their vision is a bit more, okay, beyond what we heard at the subcommittee meeting. Sorry I interrupted you, Vesna. Go ahead.

MEMBER DIMITRIJEVIC: I just noticed that I was muted actually. Sorry. I wanted to say -- I agree with Dennis that this is sort of unpractical in a lot of ways. Even I have to say was the subject of my thesis, which was then, you know, like I don't know, 25 years ago or something. And it was already considered in that time. But I do agree it's really complex and impractical. And seeing the application would be amusing. So I just -- I'm also concerned it can just complicate things further. So (indiscernible due to accent) really have a good hold on that -- on

all the aspects of the cool and statical PRAs. Okay?

Okay so the fire -- the next slide. So the fire -- you know, some projects here are sort of being sunset. So they will be localized work to be done in this area in the future. The improving fire PRA realism is now mostly in the EPRI code as I understood. The high energy, action codes, which we have discussed a lot. And now -- not considered anymore, the accident -- the GI category and the transfer back to research. And again, the EPRI, OECD, and NEA are working to advance, you know, our understanding of that risk and how can be included in the fire risk analysis.

So for probabilistic fire hazard, the assessment -- the pilot study will be completed in 2022, this year. And the regulatory guidance will be issued the next year. And then we have this new project, which is subsurface characterization and waste covers. This is a new area that we're planning to support NMSS -- NMSS and environmental projects. And it provides expertise area of the element of hazard analysis, including (indiscernible due to accent) monitoring, radon barriers, and evapotranspiration.

I don't know too much about that, but this

is the -- you know, related to the NMSS environmental projects, which supports some of the things we are interested in. So you know, dry cask and the decommissioning. But we will talk about that later.

MEMBER BLEY: Can I toss another one in here?

MEMBER DIMITRIJEVIC: Sure.

MEMBER BLEY: This is probably more for Joy, but maybe not, maybe for you, Vesna. There was a meeting back in September on this standard. Joy had (audio interference) about the transportation of small reactors before they had been used and after they had been used. And we got back that, that belongs to NMSS. My question is -- because I haven't heard anything more about that -- Is that something that NMSS is addressing in guidance or rule? Or is that something that really fits into this research topic?

MEMBER DIMITRIJEVIC: There is a slide -- That was actually 11 out of 11. So let's transfer that question and we get back to that on the slide.

MEMBER BLEY: Okay. You disputed me on this one.

MEMBER DIMITRIJEVIC: Okay, we will not forget this. Okay. Next slide. So this is on the human factors and reliability. I actually have been

following, you know, this for a while. So you know, the work on this advanced human factors; the license review guidance and things like that. So they're working now to have this scalable Part 53 review guidance for human factor (indiscernible due to accent). And also the -- related to Part 53, operator licensing -- you know, definition of operator reactor licensing requirements. So they're using this work to support the Part 53.

Also because this is the branch which has (indiscernible due to accent), you know, organizational factors and agency innovation and (indiscernible due to accent) changes. This actually, innovation project become a part of that. And we will talk in the later slides about that. This is just on the branch level summary.

So they use this organizational factor (indiscernible due to accent) to drive innovation and culture changes in the NRC. And present enhanced capability to perform external cloud sourcing for significant tech challenges. And it's very interesting that we don't know now from this moment about that. And they also testing using ideas for an NMSS application, which we will discuss later.

Okay, next slide. So this is -- because

we always want to discuss these core competencies in the Agency. And you know, this is one of the objective to building and enhance those core competencies. So there is a shortage in core positions and reliability of these engineers is expected over the next five years because of the retirements.

And the strategy to address this shortage is, you know, normal about hiring next level and a lot of staff and then develop the competencies of the greatest need of cross-training staff across branches. And currently there is an effort to find a way to (audio interference) from different fields to become experts in licensing review of human factors. They're developing training program, which will be shared internationally within country and internationally through the Nuclear Energy Agency.

Okay, so next slide. The collaboration, they have a really high, you know, collaboration, which makes perfect sense. One of our comments was that we will sort of -- in our previous slide, that we would like to see that they define their goals of -- they have a clean definition of the goals of the deliverables from those projects are. But we didn't see that, but sometimes it's maybe obvious.

So they're working in the, you know, the CSNI and NEA for the extent of advanced human (indiscernible due to accent) factors. And that's the part where they address these PRA uncertainties, which is, you know, especially useful to support advanced reactors. Then they have the internal arrangement with France to collaborate on flood-risk modeling. This is one of the projects, which is actually being sunset -- being finished, so we will talk about that still.

They are exchanging human performance data with Czeck Republic and South Korea, and also they're participating in the Halden projects of the -- looking in the -- in the operator performance and digital control room. And human performance for small modular reactors. And also for human performance in highly automated plants, which will connect to which we discussed earlier with Dennis and we could -- that could be the new sub-group looking in this connection between, you know, human performance and automatization. And of course they base it, you know, a lot of the operation with EPRI and NIST on the fire modeling and these AGAF issues.

Okay, the next slide. So sunsetting projects -- sunsetting projects of this AGAF Level 3

and probabilistic Flood Hazard Assessment Project. And it seems that only one of them has really completed the Level 3 PRA Project is (audio interference) to support licensing of advanced reactors and you know, like assessing the risk for multi-unit sites and integrated site risk. And the HEAF, even we said the kinetic issue problem has been (indiscernible due to accent) that there is still work ongoing and they will be delivering those coming due in '22. And this will be mostly to understand the risk caused by this issue.

Okay, next. So (indiscernible due to accent) Future-Focused Research Project. And they should be getting prioritization in the ranking. We actually didn't really discuss much this prioritization throughout the principles of the Preparedization Project even it was a -- one part of our letter.

So what I'm doing currently for the Advanced Reactor Program is developing PRA guidance. We had the discussion this morning on this Reg Guide. And this will also include the guidance to address the PRA uncertainty. That's a very important issue for the, you know, advanced non-light water reactors where we don't have operating experience.

And they also can do (indiscernible due to accent), the graded approach to scale and target human factor (indiscernible due to accent) reviews for small and microreactors. And that will mean to develop (indiscernible due to accent) and also develop in technology inclusive operator training and examination requirements. And they have this Future-Focused Research Project on the use of this dynamic PRA, which we just discussed and how could it be applied for advanced reactor.

And now that Joy made this comment in the reg, and I myself am not sure, do I really understand Joy's concern here because I was not really -- it wasn't my impression that this EPRI/Vanderbilt approach is taking the role of pilot application. So Joy, can you elaborate a little --

(simultaneous speaking)

MEMBER REMPE: Sure. Yeah, at the beginning of our subcommittee meeting, I believe Mark Thaggard was the one who addressed my questions on this. Two years ago we were told that DRA would have reference plant evaluations where they tried to use a risk assessment for the various technologies similar to what the DSA folks have done for source term evaluations. And you know, the DSA folks have had

public, as well as staff workshops presenting their results from evaluating reference plants for each of the technologies and the type of results they're getting.

For example, they had a pebble-bed HTGR or a prismatic HTGR or different sodium reactors and molten salt reactors that they presented results for. And I have -- I asked Mark actually in our pre-meeting before we actually heard from his division, what happened to the reference part evaluations? What's going on? And he said, well we're letting Vanderbilt University do it. And then he mentioned some of -- briefly the results during our subcommittee meeting. And I asked to hear more about it and see more about it because it seems like the Division has basically -- they're involved in it, but Vanderbilt's going to have the lead on it.

And I'm not sure that's the right approach that should be taken. However, they sent me this EPRI/Vanderbilt -- They sent it to all of us. Hossein got it and forwarded it to us. And they basically are using a concept called Safety in Design, which is a process hazard assessment where they use HAZOPs. And they did it for one molten salt reactor. And you know, with -- And we discussed this during P&P today

when Dave was talking about the staff is looking at a graded approach to PRA.

And actually in the Part 53 subcommittee hearing last September, we heard that staff is also because of stakeholder comments, they are thinking about what could be done for the stakeholders. They're saying we don't want to do a PRA at all, not even in a secondary role. We just don't want one. And this Safety in Design approach is something that I think -- it would be good for the subcommittee -- the whole committee to look at. Because it is a systematic approach to try and look at where the radiological hazards are. And they try and identify the initiating events and do something with that approach.

So I think we -- we don't have enough information to have a solid recommendation here. And us folks just think it's a bad idea for the staff to turn it over to the university and participate in a secondary role, which is one thing -- Again, I don't have the answers here. There's just possible options that the committee may want to think about. But if we hear more about it, which I would like to hear more about it -- and it may be from this Part 53-related subcommittee meeting, we might think this is a viable

approach for dealing with some of these non-LWRs.

And they actually -- they didn't get very far, but they even talk about it in this EPRI/Vanderbilt report about trying to think of other risk metrics that could be used because we've also struggled with that. We can't use core damage frequency or some of the other surrogates for the QHOs. And what they proposed was a huge -- a significant change in release might be an approach.

But anyway, I think that we ought to have some comment on it since it was brought up to our attention in the research review about this approach. And that we plan to investigate it further as a minimum type of comment we ought to have on it. And that's why I've had this comment and I didn't just delete it like I have other comments I've had for others because I wanted to make sure this got discussed today. And again, there are some gaps. There's nothing about transportation to or from the site of a small modular reactor in what EPRI/Vanderbilt did.

And your comment about -- that earlier Dennis, it showed up in another subcommittee meeting -- the EP meeting that Greg shared last month. And I at the time asked about that. And I was also told oh,

transportation's an NMSS thing. And I made the comment to myself, it sounds like a lots being turned over to NMSS and we need to track that. So it's on my list of to-do's to mention it somewhere, we need to track it. Because it seems like it's being thrown over the fence. And I'm not sure how -- you know, we ought to follow up on that too by the way, Dennis. So I'll shut up and let other people put their comments in.

(simultaneous speaking)

MEMBER DIMITRIJEVIC: -- on the 11th slide of these observations. But however, what I want to tell you that I didn't really visualize this as a replacement. It totally didn't mean to me that NRC is turning things to the EPRI and Vanderbilt University. What they are exploring is one different method -- which is just one of the different methods that NRC is actually considering using for the PRA partially or the PRA replacement that we also had, you know, to discuss the (indiscernible due to accent) objectives. But the thing is for me, I don't know really why we think is the -- are you told explicitly like this is what they consider a place reference plant because that would not make any sense.

MEMBER REMPE: That was my take from the

subcommittee meeting and it's in the transcript. If I'm wrong, let me know. But that's what I read and I heard.

MEMBER BLEY: Well, if I could jump in here a little bit since you mentioned me a couple of times. Just a few different comments. One, this Safety in Design, it smells a lot like PRA, but maybe a modified approach to that. But you know --

(simultaneous speaking)

MEMBER BLEY: -- in developing this are some PRA people. It's not -- It's pretty clear that the Vanderbilt people are the organizers and got the funding from EPRI. But the people who worked on it are a real mix of people out of industry. Some might now be at Vanderbilt or consulting with them. Also one of the -- one of the vendors is in here pretty strongly. So the staff can't be turning over this to the vendors. There's more than meets the eye here, I suspect. And if you look at the list of names of the people who are heavily involved in that report, you'll see an interesting range. Anyway, I'll step out.

MEMBER REMPE: Okay, so just real quick, Dennis, it's two of the three questions. It's called a process hazard assessment. So they don't address frequency at all of the triplet three questions to

answer. And that's identified in the report. And the report talks about, it's supposed to be a PHA to PRA approach. And then as they worked on this, they came to the conclusion you don't necessarily have to go to a PRA. And so again, we're hearing this from the staff in Part 53, as well as from the research folks.

CHAIR SUNSERI: Hey Joy, Vicki has her hand up patiently waiting to interject.

MEMBER REMPE: Thank you. Vicki, go ahead.

MEMBER BIER: I'm muted. There we go. I just wanted to comment kind of general. First of all, I agree we should at least be keeping tabs on what the Vanderbilt group is doing and how it fits into the NRC plans. But also just in general, I think the idea of doing safety analysis as kind of a qualitative design process, rather than a PRA, whether that works probably depends a lot on the simplicity of the design. And part of why we end up with such complicated PRAs is because we have complicated plants with a zillion pumps and valves and everything else.

And there the frequency becomes really crucial because there's so many zillion scenarios. And you have to have a way to figure out which ones to prioritize and really look at. And if you have a

really super simple design that's operating more from the basics physics with fewer active components, it may be possible to have a more qualitative approach that does a pretty good job.

MEMBER DIMITRIJEVIC: Thanks, Vicki. Thanks. I do agree on a lot of that. I had the chance actually last night to look in this report. And I have through our meetings in 53, advocated there is a lot of portions of the PRA which are not (audio interference) necessarily quantitative which can be used, you know, to make conclusion. And if you need to have a -- One of the -- why this study was built based on what I have -- you know, I haven't studied in detail is to -- if you have to make this design decision early in the process when you're designing plant and you don't have a fully developed PRA, there should be some other approach actually available for that. And in my sense, I think it's very interesting work.

I agree with Joy that we should definitely look in that. But I don't think that we should be sort of concern that, that's replacing reference plan. And we should definitely suggest to the staff to renew their interest in the -- you know, having reference plan for the -- you know, 10 CFR 53. Okay --

MEMBER REMPE: Vesna, just a second. Again, that's an important recommendation. And I'm with you if that's what the ACRS wants to do. So I just think that's an important recommendation we ought to definitely --

MEMBER DIMITRIJEVIC: Right.

MEMBER REMPE: -- write up. So thank you. I just didn't know what we should do --

MEMBER PETTI: So are we just personally recommending that we want to hear more about this under the umbrella of Part 53, which is sort of what we decided this morning?

MEMBER REMPE: Yeah, we'll have some -- We are pursuing this matter. We don't have to say where. It gets very convoluted with what's going on now with the Agency with Part 53 versus research and actually even the Digital I&C and other places. It's an integrated approach.

MEMBER DIMITRIJEVIC: Yeah. Okay, I'm not sure how this -- technically that really works. So I -- I mean I definitely would be interested to hear. Can we recommend that or not? I'm not sure. So I think we can definitely recommend they have a -- renew this reference plan process.

Okay, so the next slide. So in the next

slide, I want to talk about this innovation -- the process -- that actually this innovation activities is now leading this department, which is very interesting. So DRAs are one of two places as we have been informing the Agency, which has this organizational factor specialists. And that department is this Office of Chief Human Capital Officers. And the (indiscernible due to accent) Office of Nuclear Regulatory Research.

And so when this push for the innovation started looking for staff members from the Human Factor Reliability Branch move to the ED Office and provide the technical support role. So they help you -- what they call innovate NRC to (indiscernible due to accent) the program. And that program includes infrastructures and the procedures and process for maintaining and sustaining innovation.

So basically it's a part of this program as I understand, that builds this infrastructure and procedures and process for innovation in the Agency. I am not going to -- You will see later in the recommendations that, that's when ADR will be interesting to see what they have done and how they coordinate this and how do -- how does this process work. We have not learned too much about that.

Okay, next slide. The (indiscernible due to accent) increasing the (indiscernible due to accent) they have (indiscernible due to accent) having innovation. Okay, so some of innovative as I put in the (indiscernible due to accent); one is this (indiscernible due to accent) PRA, which we discussed before. And since it has this time element in the -- time dependency element, it has the potential to provide, you know, additional use with (indiscernible due to accent) and I mean, even there is not too impractical.

So final report documenting those results is expected in the middle of the next year, in July of 2022. Also they're doing limited work on artificial intelligence, mostly with DOE and to use artificial intelligence to analyze operating data. And possible future projects they consider effects of extreme weather events and security area -- support of the physical security area itself. Those are the new projects they're considering starting.

Okay, here comes this 11/11, which talks about the transportation NMSS and the dry cask storage. So yeah, they're currently looking to expand their support to NMSS. That's the next slide. Sorry. Sorry. Sorry.

MEMBER REMPE: Vesna, before you leave this just to emphasize what I was talking earlier wasn't just for licensed geostorage and transportation. I'm talking about people who want to move us -- a small modular reactor with a loaded core to and from the site. And they're also passing that over to NMSS. Right?

MEMBER DIMITRIJEVIC: Well okay, they cannot -- Sure, so I will tell you what they have -- the NMSS is doing, they're supporting them. And then we can talk about it. I didn't get the impression if you mean -- I know you're always concerned about modules moving. So I didn't get the impression that this is the -- that NMSS will be working on it.

MEMBER REMPE: Well whenever we ask what are you going to do with the spent modules and what about the risk and moving it to the site and starting it up and then afterwards storing --

(simultaneous speaking)

MEMBER REMPE: -- marking a lot of them and then taking them off site, we are now getting it bounced over to well, NMSS will take care of that.

MEMBER BLEY: Joy, it's not really bouncing over. That's always been a materials issue and it's always belonged to NMSS. They gave the cask

certification. They do anything associated with transportation and they always have as far as I know.

(simultaneous speaking)

MEMBER PETTI: And I think that it's important to recognize that there is a regulation, Part 71 is what is being used to look at requirements for transportation. The biggest difference is that it's not very risk-informed. It's very prescriptive. But it's written at a high enough level that, you know, it's used for spent fuel largely, but it can easily be used for the reactor. There are requirements on criticality. There are requirements on radiation dose. You know, all the things you'd expect to see.

MEMBER REMPE: But the kicker is then okay, what about when you're trying to pick a site boundary? If it doesn't go off site, it's another source of radiological hazard. What if you have -- We've learned now that one of these advanced designers wants to heavily emphasize the difference between spent and used fuel. Again --

(simultaneous speaking)

MEMBER PETTI: -- that's not a -- that's not a transportation issue. That's a site issue.

MEMBER REMPE: Well, if you don't

transport it off while you're -- Anyway, the issue is, is that we need to have an integrated approach and follow both. Right?

MEMBER PETTI: Yeah.

MEMBER DIMITRIJEVIC: Currently what this Department is trying to do is to help NMSS to develop risk tools to look in this, you know, dry cask storage into the spent fuel dry storage. They're providing both support in the risk tools and now the new thing is the supplemental support, which we discussed. So whatever, you know, currently is going -- and this also covers transportation, you know, the risk tools to help future review of transportation packages, those tools and the supplemental support will apply for extension that could be -- that would be different model approaches. But it will apply to extension of those -- you know, those activities.

So what we hope here is that transportation, dry cask storage, the commissioning problems, spent fuel dry storage. You know, so I think at this moment how it works, it's perfectly fine. But it needs to be extended to other things or we can already discuss in our recommendation, you know, they can keep in the -- the developing risk tools that can keep this in their mind. They could be

extended for blah, blah, blah.

You know, so we cannot let our recommendation that this support to providing to NMSS to be, it would never be covering risk associated with (indiscernible due to accent) can be extended, to you know, different subjects.

MEMBER REMPE: Okay, I've got it in the notes. Thank you.

MEMBER PETTI: I mean is it worth -- Do we think they should -- you say developing risk tools, but risk informing some of the regulations in transportation. Is that worth knowing --

(simultaneous speaking)

MEMBER PETTI: -- evaluate the potential --

(simultaneous speaking)

MEMBER DIMITRIJEVIC: -- risk tools. Right? Does it cover risk tool --

(simultaneous speaking)

MEMBER PETTI: Okay.

MEMBER DIMITRIJEVIC: -- then we could consider what we would like to risk --

(simultaneous speaking)

MEMBER PETTI: Yeah, okay.

MEMBER DIMITRIJEVIC: All right. Yeah, I

mean obviously there is no (indiscernible due to accent). I mean there could be, I mean, you know, but it's under different level. You know?

MEMBER PETTI: Yeah.

MEMBER DIMITRIJEVIC: It's a different frequency base.

MEMBER BALLINGER: I might add that there is this ongoing or at least developing program at the Agency to deal with the consequences. And I think that will -- of dry fuel storage leakage. And that may transition into a risk-informed operation, which would then in the long-term affect Part 72.

MEMBER DIMITRIJEVIC: Right, Ron. This big report was this EPRI report. I didn't remember seeing this. I forgot who was it done by.

MEMBER BALLINGER: Yeah. There's a user need that's going on and we're following that with regard to the consequence analysis.

MEMBER DIMITRIJEVIC: Right. And that would be part of the -- of the, you know, part of the risk analysis. Okay.

MEMBER BALLINGER: Because Dave is right, Part 72 has got to change if you're going to do any of this. Because Part 72 simply says "no leakage."

MEMBER DIMITRIJEVIC: Okay, that's some of

the -- I see some sign here. Does that mean somebody raised their hand? I cannot see this. Okay, I don't see any hands raised. Okay, so this was basically everything what they're doing. And then I tried to combine this in the conclusions.

So next slide. So next slide, I have this high level conclusion. One is that they're sunsetting some projects, which was a part of our recommendation and discussion, you know, in the previous review. But they's finally renewal for ongoing projects. And I think that's -- I thought that was very positive. And they are considering using Level 3 PRA to support licensing advanced reactors because, you know, it goes (indiscernible due to accent). And so it can support the (indiscernible due to accent). And also to develop the Part 53 human reactor review guidance and also operator reactor licensing requirements for advanced reactors. I think that's another positive development for those two projects which were reaching end -- (indiscernible due to accent).

And also as they said, DRA has this new important role in the Agency transformation effort to overseeing the innovation activities by utilizing organizational factors expertise to drive innovation and capture changes. And that sounds very good. I

just don't know how it's done. So we will support this effort, but we don't have enough information to analyze how it's being coordinated and what have been accomplished so far. So we can, you know, maybe this part is our next review to get familiar with that.

Okay, the next slide. Also they have twice brought up their interest in addressing PRA uncertainties in both the regulatory guidance, you know, like for the advanced reactors and also for HRA efforts. And I think we should strongly support this effort because there is clear needs to have a guidance on how to utilize uncertainty results in regulation. And it's especially important when we now talk about reactors where the new design features where we have no operating data and also we don't really have modeling experience in that -- in these reactors, you know, so it will be -- I mean a lot of uncertainties associated with that. So a little, you know, guidance in this area would definitely help.

And the last one, these new projects -- they have new projects. One is to see how dynamic PRA may be used for advanced reactors. And we have this NMS-related support projects. And also they were considering these possible future projects of analyzing effects of extreme data and you know,

supporting physical security areas. I even saw some risk with the (inaudible) program or something. But I saw that in transcript; however, I didn't remember that from discussion.

So what we can notice from there that all of these new things are sort of general. And they're not really projects that can eventually support advance reactors like extreme data. But they're currently more than 80 percent of DRA work is in operating reactor business line and less than 10 percent in advanced reactors. So significantly less. So I think that we should really, you know, express our hope that we will see that those percentages are changing in upcoming years. And that more work is dedicated to the -- to the advanced reactors.

CHAIR SUNSESRI: Hey Vesna, I have a question about that.

MEMBER DIMITRIJEVIC: Sure.

CHAIR SUNSESRI: I mean just think about the presentations we had this week on the non-light water reactor standards. I mean, you know --

MEMBER DIMITRIJEVIC: Right.

CHAIR SUNSESRI: -- much of the work that is done for the operating fleet is applicable to the -- I mean, you know, they're almost agnostic. Right?

I mean, it's how you do analysis -- risk analysis. It's a process, not necessarily technology-specific things. So I mean is it fair to say just because only 10 percent of the work is advanced reactors that it's not being advanced proportionately?

MEMBER DIMITRIJEVIC: Okay, well it's not being advanced proportionately -- What would that really -- What would that imply? That we are saying that --

CHAIR SUNSESRI: Well, what I'm reading this is saying is that we're doing 80 percent of the work on operating reactors in (inaudible) and we want to see that shift to I don't know, 50/50 or something? You know, but --

MEMBER DIMITRIJEVIC: Yes. Yes.

CHAIR SUNSESRI: -- what advantage is there? I mean is part of the 80 that is operating reactors applicable to the -- to the advance as well? I mean it seems to me it is.

MEMBER DIMITRIJEVIC: Yes, that's (audio interference) -- big percentage of operating things is applicable for the advanced, but may not. I mean you know, it may be totally new design, totally new issues. And the main point is that we already -- in my opinion, that we already know a lot, you know, in

the -- You know, like for example, let's say that we are concentrating on the cable fires and the fire is really sunsetting a lot. But you know, this will definitely be applied for the all new designs. But for example, some new type of the fire risk because of the (indiscernible due to accent) interaction and we are not looking at all. And that can come with the new reactors. You know?

So I just want to say we have some, you know, when it comes to research, you know, this is not work in general (indiscernible due to accent). I think that we should increase definitely searching what we don't know.

MEMBER REMPE: So this is Joy. And I think -- again, sometimes we get told to not focus -- We do ask them for percentages of funding, but that's so we understand the resource allocation. And I think a better -- because we get criticized if we swim out of our swim lane. You mentioned already in your presentation some ideas that would accomplish what you're saying here, Vesna. Like you thought they should reconsider the PRAs -- the reference plant PRAs for non-LWRs.

There's the issue that has come up several times that you've actually brought up Vesna, about

what metrics should be used for non-LWRs? It's for surrogates for the qualitative -- the qualitative health objectives. So I think we suggest some projects, that they should reconsider for research, dynamic PRA applications, et cetera that, that would accomplish your objective. And maybe avoid what Matt's suggesting as a comment. What do you think?

MEMBER DIMITRIJEVIC: I mean, you know, I wasn't sure that it would be necessary for this (indiscernible due to accent). So in general, yes. And I would be too like, you know, hesitant because I'm not sure I completely understand the concern why we object to increase. But that's okay. So Dave has hand raised. Dave?

MEMBER PETTI: Yeah. My thing would be maybe be a conclusion that they should engage more and use their expertise as Part 53 with this graded approach to PRA that they're struggling -- They've got a working group, so they probably are doing that. But they didn't really talk to us about that at all. And given the stakeholder comments of late, I think it's going to be a pretty important topic. I mean I'm assuming that the Agency reaches out to the expertise in DRA. I mean there's a lot of risk assessment expertise, both in NRR and in DRA. So I'm assuming

that they know each other and they reach out as appropriate as indicated by the, you know, the reg guide we just looked at. And the presentation was from somebody from RES and somebody from NRR.

MEMBER DIMITRIJEVIC: So we should be careful how we phrase this. I mean I can see that. I just want to say we don't see -- we see a lot of issues when we talked to NCSI, but we don't really see the NRC is doing research. (indiscernible due to accent) is this relative importance measures because it's extremely important thing if we're going do this risk-informed thing is to understand how you're going to rank importance with the plants which already, you know, low risk.

And you know, the thing is like we say we're doing risk-informed applications, but you know, nobody really defines what risk -- what the heck are we talking about. So we are just trying to phrase this without really trying to understand what we are trying to accomplish. I mean the (indiscernible due to accent) at this thing or at least maybe review of the little (indiscernible due to accent) forming the task, but maybe that's not for the NRC. (indiscernible due to accent) I'm staying out of that. I mean obviously the different departments do the

different things. And maybe they didn't ask for help from the Research Department.

Okay, well this is -- I'm sort of basically done. I see that Joy put a little comment here. I'm delighted to hear her comments on the Vanderbilt things which we already discussed. Okay, so basically this doesn't mean that this is going to be our recommendation. That was my thinking in this way when we write our letter and we will put on this discussion and things like that, that we can ask (audio interference) better. Okay.

MEMBER REMPE: Thank you, Vesna. And I apologize. I should have cut off that comment on the end there. It's late night changes that I didn't quite incorporate, so my fault. But anyway, let's go on to Dave's presentation. And let's try and go as fast as you -- I mean let's try and do it in 25 minutes like we originally said. Okay, Dave?

MEMBER PETTI: Oh yeah. I only have, I think, five or six slides. So, Division of Systems Analysis talks about what they do. They develop and maintain a wide spectrum of codes that are either state of factors or state of the art. They're in four branches. They have core competencies in the usual things that you would expect given the system analysis

and the developing new competencies in -- I call it advanced reactor behavior of data science and artificial intelligence.

So next slide. In terms of prior recommendations, they have been implementing the non-LWR code integrated action plans. Remember, the multivolumes that Kim and her staff have talked to us about, emphasizing simplified solutions for estimating source terms, focused on developing and maintaining in-house codes and capabilities and expertise. And using these advanced reference plan evaluations to assess the modeling capabilities and the data gaps.

They're trying to develop longer term strategy for code maintenance. We heard about that. They've got a new person that came out of, I believe the DoD to help them think about strategic planning in this area for code maintenance, consolidation, development -- code development and how to integrate the needs of the emerging technologies.

Next slide. So we suggest the findings that -- I mean my draft write-up is that the breath and depth of the capabilities in the division are critical to providing that -- the technical basis for the reasonable assurance findings that you know, the Agency develops. We have numerous international

collaborations, you know, all of the different departments, to leverage experimental capabilities around the world. It would have cost NRC hundreds of millions to replicate that in the U.S. So huge leveraging, very valuable for them.

And also that the codes that they use, all of them in this -- in DSA have a large international set of users. And to me, that's a testament to the quality and value of the DSA product to the international reactor safety community. If you look at -- I can't remember what it is -- the National Academies were asked to talk about the quality of research products. And they said that the best metric for quality is being recognized internationally. And I can clearly -- the DSA products given the use of -- international use meets that criteria.

Next slide. You know, they've got this balancing act to look at current needs and future needs, you know, acts in (inaudible) fuel, high burn-up fuel and advanced reactor applications. Those are big issues on their plate. And I thought it was very admirable, the balancing that they've been able to do given the changing reactor technology environment.

Their preparation for advanced reactors, the application is coming along well, I think, across

the range of anticipated technologies. We expect to hear more from them this year. The reference plan evaluations have identified gaps to help prioritize data needs and establish the adequacy of their confirmatory tools. The recent daily funding awards and the Advanced Reactor Demonstration Project has helped NRC prioritize its research activities. And just note that this balancing is critical to performing code research at the right time.

Next slide. I thought the code investment strategy was sound. It's a holistic assessment focused on needs over a longer time period, five to seven years over the historic three, to have the greatest impact to the Agency. Also this new agency wide data science and artificial intelligence initiative seems to be a worthwhile endeavor. Good definitions, standards, and use cases are going to be critical to be a value to the NRC. The impact on reactor safety, specifically the biggest areas, autonomous control and vulnerability assessments needs to be established. Getting started on this work earlier I thought was laudable.

Next slide. That's it.

MEMBER REMPE: So you did it very fast. This is Joy. So I know, you know, that I've made the

comment about do you have any recommendations? You know, something to help them do a better job. And some ideas that I came up with when I was looking through the transcript were coming from other member comments -- from that meeting, as well as some prior meetings.

For example, one member said about the code investment strategy, they ought to try and go for a longer period of time. I mean what they've done is great because they have never tried to think about five to seven years. But should we also say they might want to consider going longer? There was one member -- I know it's in the integrated assessment about this is a substantial effort that may require a lot more resources. The integrated action plan reports that we reviewed as part of -- I don't know, the non-LWR effort or future plants efforts. At one time, we said are they ever going to update these reports? Did we want as a group to say they ought to consider updating these reports at some point in the future? Do you have any ideas about what you'd like to recommend for changes, Dave?

MEMBER PETTI: So I thought ten years was too long right now in such a dynamic environment. It's hard enough, I think, for them to see five to

seven. So I mean if we put some words in, you know, where practicable, they could look longer. But for instance, you know, in the advanced reactors, we don't know which ones are going to come through and make it to the finish line. So I think that's difficult. But in other areas like the dose calculation of stuff and some of that, they may be able to look further and still see value for looking longer. So we could work that in.

MEMBER REMPE: So okay, the five to seven year investment strategy, if you think about it, they didn't develop any new codes for non-LWRs. They use MELCOR. And for some cases, they were able to use trace. For the dose calculations, they're using MAACS and other codes that existed. So again, maybe not for those models, but the codes are their codes. Right?

MEMBER PETTI: Right, although they have, you know, agreed for some cases to go to the DOE codes where they --

(simultaneous speaking)

MEMBER REMPE: And I'm guessing that the investment strategy is not on any of the DOE codes because DOE is paying for those. Right?

MEMBER PETTI: Yeah, I mean I guess I took investment in a broader sense. Not just dollars, but

you know, people, resources, just the whole enterprise. But you know, until -- I think it's just hard for them to see beyond what they -- where they are today. I mean five to seven years.

MEMBER REMPE: I may agree with you. In the U.S., it's always essentially -- although their funding's reimbursable from licensees. But anyway, it's always hard to predict the future.

MEMBER PETTI: Yeah.

MEMBER REMPE: You may be right, but I just am trying to push it and think about is there anything you want to suggest that they do differently? Any gaps?

MEMBER PETTI: You know, until we get further into the actual applications, I don't -- I don't -- at this point, I can't see any gaps. I mean I think that they're well set for both Natrium and X-energy, I think that they're good tools. Thir tools obviously in salt systems, a little behind that. But I don't think there's going to be something, you know, pounding at the door immediately. In terms of the dose, everything's sort of consequence. I mean we're hearing about it in pieces and parts, but my sense is that, you know, it's going to be -- they're going to be in pretty good shape when we see all the pieces of

the puzzle.

MEMBER REMPE: Okay.

MEMBER PETTI: And again, my concern updating -- I just hate creating bureaucracy. I'm not a big fan of -- I mean having lived in where you update plans all the time. They're very limited on resources and I'd hate to recommend something that requires them to use resources on, you know, more paperwork. If I saw a value to it, I guess I would.

But maybe what we would recommend instead is, you know, not updating the four volumes, but sort of a status report against that plan. You know, how are we doing? What do we have to do different? Are there course corrections? But it could be sort of an annual addendum to those reports so that they don't have to carry. And those are four very large reports to have to carry on and do revisions.

So maybe something that says, you know, just tell us where you are relative to where you thought you'd be. You know, would be something that would maybe balance the resources a little better because of what it would take to get something like that done.

MEMBER REMPE: Okay, I did. I'm just trying to kick the tires a little bit. I'm not trying

to force you into anything, although I kind of like the idea of a status report. But it's something to think about.

MEMBER PETTI: Yeah.

MEMBER REMPE: Do any other members have any comments or questions?

MR. WIDMAYER: Hey, Joy?

MEMBER REMPE: Yes.

MR. WIDMAYER: This is Derek. I think Kim Webber from the Office of Research would like to ask a question or make a comment. Is that okay?

MEMBER REMPE: Sure. Again, you're not allowed -- I'm sure you know, Kim, so I don't have to repeat it. But you're not allowed to give editorial comments. At this point, we're kind of close to letter writing. But factual corrections, updates.

MS. WEBBER: Sure. Yeah, the only thing --

(simultaneous speaking)

MS. WEBBER: I was going to chime -- I was going to chime in, but I think you got it. I just want to clarify that the code investment plan is a strategy document that identifies what the code development needs are over five to seven years. And so that helps for us in regard to budget formulation

and execution. Whereas the IAP strategy documents identify the specific tasks and activities that need to be completed to get us to a certain point relative to readiness to perform, you know, analysis and calculations. So the two are related, but they're different. So I just wanted to put that clarification on the table. But I think you understand that from the follow-on conversation that you're having.

MEMBER REMPE: And so my interpretation is that the investment strategy is not just limited to non-LWR applications. It is for the whole thing, what your (audio interference). For example, Fukushima detects a new something or other for vessel failure -- that would be -- or instrumentation. That would be included in this investment strategy and it has nothing to do with non-LWRs. Right?

MS. WEBBER: So the code investment plan broadly covers the NRCs 40+ scientific computer codes of which the codes that we're working on in the context of advanced reactors, BlueCRAB, MELCOR, and MACCS, they're a subset of those 40+ set of codes.

MEMBER REMPE: That's my understanding too. And I think Dave understands that too. It was just the answer implied it a bit differently. And I think we -- we beat that horse to death, but thank

you.

MS. WEBBER: Okay.

MEMBER REMPE: Any other comments from members on Dave's -- Then let's go on to Matt's section please.

CHAIR SUNSESRI: Thank you, Joy. One of the advantages of being last is that a lot of this stuff has already been said. So I'm not going to repeat some of the things that have already been said about competencies and how they're deploying. I'll touch on the specifics related to DE. But design engineering is right up their presentation on the website, what they're responsible for.

So let's go to the next slide. The competencies that were -- that were discussed, either that I identified through looking at their public website, the things that were mentioned in their presentation and looking at their transcript, things that were said in response to questions, these are the various competencies. And it's a tough call to separate our core and developing areas from a group like this. So if you put them all together on one slide, they seem appropriate for the level of work and responsibilities that the group is embodied with.

And just as an example of something that

you might consider developing is you're looking at the molten salt -- molten salt fuel cycle. So that's obviously something new when you compare it against metallurgy and NDE, which would be established competencies that they've had. And you know, they're deploying the entire variety of things that we heard in the other presentations. You know, reverse of rotations and national ads, and more use of virtual technology because the pandemic has restricted cross-sharing of people if you will, and things like that. So does anybody have any comments on just competencies?

All right, we'll go to the next slide then. They did a good -- They've done a good job of addressing activities and prior ACRS recommendations. They've obviously even through the pandemic, they've increased external engagement through the virtual platform, engaging in non-nuclear technology with things like the Advanced Manufacturing Technologies and a little bit of the big data stuff.

We had a recommendation about Halden Gap at the time when the Halden was being taken out of service. And they've actually -- we had a separate briefing on that, so they're addressing, you know, our comments from there. Although there's still some

longer term data that need to be addressed. And we'll be following that with them.

Other things that are continuing to -- How do I want to say this? Okay, so one of the things that we look at is the nature of their work. Is it ongoing? Does it need to be ongoing? Has it met its objectives? Can it be sunset or whatever. They do a good job of looking at their work critically. And we would agree that to digitalize the action plan is on track and these can be continued to develop and progress on that. It's not quite reached its end point yet as we know from our numerous subcommittee meetings with various groups on the topic. And they are being self-critical as far as sunsetting some projects like the embedded digital device research. They've discontinued that now because it's reached its objectives. So good job there. Any other comments on this slide?

We'll go to the next one. Some of the highlights and observations, this is just stuff that we've talked about. And this slide is -- I didn't construct this very well here. Some of the things that we've talked about coming into the meeting where we were interested obviously in the digital twin business and we got a good presentation on that

advanced manufacturing technology, harvesting. These are all things and areas that we were looking at going into it. What we heard were some successes. They've strengthened their reg guide group. They've combined some things such as project management into the reg guide review and a bit of process overhaul and the turn around their reg guides in a much faster pace.

I do have a recommendation on the next slide there that we'll talk about. We've already talked about some of the project terminations. And we were also interested in identifying areas that we might interface with them in the future. This is just kind of a list of things and we'll get to the details on the next slide and the recommendations.

So let's go to the next slide. Here's kind of the conclusion and the sum-up of the whole review of the area. So in the area of -- in the topic -- on the topic of advanced manufacturing technology, we had a good discussion. And obviously there's a lot of advancements, so there are parts being made right now for reactor service in this. And not safety-related parts, but parts nonetheless.

So our questions were really centering around what are the quality assurance requirements going to be for really safety-related components or

(inaudible) components if you want to call them that. What the group is doing. What is the group doing to identify what QA requirements might be unique to AMP as opposed to any other manufacturing process? So I guess the recommendation would be for them to consider, you know, more emphasis on identifying what the unique quality assurance requirements would be for advanced manufacturing technology. And since they're right in the middle of doing -- doing the work on that, it would be a good opportunity.

I don't know a lot about this. I mean we had a discussion about the progress and viability of risk-informed performance-based seismic design. I know the committee probably has some differing opinions on performance-based seismic design and how do you do that. So I just -- Vesna or Dennis, anybody want to weigh in on this?

MEMBER DIMITRIJEVIC: I don't really know too much about that, Matt. I'm not sure how it will work, so I would just have to get informed about it.

CHAIR SUNSESRI: Yeah, I -- you know, I pulled this out the transcript. I'm going to have to go in there and do some research on this. But I think I cut somebody off. Dennis, was that you?

MEMBER BLEY: Yeah, it was me. I think

what they're after there -- and this is something that will be good -- is being able to dig into things and find out the physics of failure. Just what went wrong so you can do a better job of designing and maybe predicting failures. But I don't know much about it beyond something like that.

MEMBER HALNON: I don't either, but I think it's a continuation of, you know, I think they're called the (inaudible) where you look at experience and what happened and the structures that you have (audio interference) I think it would be a good topic to get to.

CHAIR SUNSESRI: Okay. Yeah, I'll do a little bit more research on that. And we'll have something better -- more descriptive for the letter report. (audio interference).

Okay. All right, guys. Let's see here. Plenty of discussion about digital twins and how that technology might be used in the future. We had internal questions from the members really setting on digital twinning sounds a lot like simulation. And we've been doing simulation. We have years of simulation experience in various things and what is the branch doing to leverage simulation experience and their continuing development of these digital twins?

So I think there might be a recommendation in there for some partnering or some collaboration if you will with other industry similar to what they did with the Advanced Manufacturing Technology and the big data stuff just to get the lessons learned out of others that may have been down this road already. And how it might influence what they are doing with the digital twinning.

This next area, I mean we've been kind of around the block on material harvesting. It's too expensive. What value does it add? You know, all these kind of things. There's a unique aspect of it that was discussed in the working group meeting because there is still some work going on here, especially internationally. Of course, there's unfortunate opportunities in the U.S. with some of the plants that are being decommissioned and taken apart. Since you're taking them apart anyway, can you harvest that material effectively? But instead of using the material as kind of a validation of things that have happened, can this material harvesting data if you will, be used to start tweaking models in a way that makes them more predictive in nature?

In other words, you know, we've heard a lot about interpolation. But what about

extrapolation? Can you use this information coming from this new round of interest in material harvesting to maybe think about the models in a different way and make them more predictive in nature? Especially with things like concrete and some of the other materials.

Okay, Walter had some thoughts ono this. And I did not -- wasn't able to talk to him beforehand. So before I get too far, I know Ron Ballinger has some comments about the digital twinning. So did you have anything you wanted to add about the digital twins, Ron?

MEMBER BALLINGER: I mean -- digital twin is at least in my mind, a buzz word now that will change two or three years from now. But the advent of these advanced computing systems -- high powered computing systems, you can do modeling, which you couldn't do before. So that's what digital twinning really is. But you know, I mean it's the word that people are -- people are using. I think the -- nobody's starting from scratch. They act as if digital twin sort of came full blown from somebodies forehead when in fact it was an evolutionary process where you now have modeling capability that's much more faster and you can be more detailed.

The comment I made in their presentation

was that they -- they don't -- they already have a fair amount of expertise at the agency with their code development and all that kind of thing. And they should leverage that if they can. They don't need to go hiring people to do digital twin modeling.

CHAIR SUNSESRI: Okay. Thank you for that clarification and insights.

MEMBER BALLINGER: No, I mean I'd be absolutely astounded if the NuScale plant, their simulator is a digital twin.

CHAIR SUNSESRI: Right, yeah.

MEMBER BALLINGER: You know?

CHAIR SUNSESRI: And you're right about the -- you're right about the concept of digital twinning. I'm in an organization called the National Associate of Corporate Directors. And I hear often times presentations on organizational digital twinning where they will go model an entire organization and kind of run it in parallel to see how different, you know, the product line changes might affect the overall outcome. So it is interesting work and I appreciate your comments.

(simultaneous speaking)

MEMBER BALLINGER: And if you go down to oil industry, some of these refineries, the ones that

aren't, you know, circa the Stone Age, they all -- they run digital twins of that system in real time.

CHAIR SUNSESRI: Right. Okay, thank you. Just two more points here. The bullet that's here on the screen is -- the next one is the effectiveness and lessons learned from future focused research. This is captured under this branch discussion (audio interference). It broadly applies to everybody. So the research office is undertaking this future focused research project or process. I think this is maybe the start of the second year of it. And so, you know, it would be a good opportunity for them to kind of step back from the process a little bit and see if it's giving them the results that they were looking for. And make any course adjustments for future -- you know, identification of future focused research needs.

I know that the office director is very, you know, supportive of this whole process. Ray has talked to us a number of times on that. So you know, making sure that they're getting the best out of -- the most out of this would -- most out of your research and energy would be ideal and the basis of our recommendation.

Anyway, the last thing I have is -- it

kind relates back to a note on the previous slide where I was talking about regulatory guides and the process and improvements that they made. And it didn't make this slide and I apologize for that. But one of the things that's kind of a backwards recommendation actually. Not withstanding the successes that they've touted about the changes in the regulatory process, they do see a continuing opportunity to make it even better by engaging the ACR. That's earlier in the process review of the reg guides and particularly their thinking about the draft stage before they go out for public comment. I know a lot of times we wait until after public comments.

And you know this -- you've heard me say also before, there's a balancing act sometimes on these things because we don't want to get so involved in the -- in the front of the thing that we actually, you know, are co-creators if you will. Because at the end we have to be independent and judge the work independently. So it's something to think about and I'll work with Joy to see how we might capture that thought in the letter report. But it would be -- it would be kind of like a mirror -- looking at the mirror on that recommendation. What are we going to do? Or maybe we can turn it into how can they help us

kind of a recommendation.

Anyway, that concludes my part of the presentation. Any additional questions? Thank you.

MEMBER PETTI: So Matt -- Matt, this is the last bullet on this slide. It seems like it's something that cuts across all of -- all of them. So it's a conclusion that we should put in the section of the report that's not just DE specific, but --

(simultaneous speaking)

CHAIR SUNSESRI: Yeah, I agree with you there.

MEMBER REMPE: I also agree. I have a -- in the integrated assessment, I have a topic of future focused research with a recommendation. But I didn't quite capture what you have here, Matt. And so when we get to that slide, remind me and I'll type it in my notes. But I think I got it in your notes too -- on the notes on your slide, so we'll get it. But yes, I agree.

CHAIR SUNSESRI: Thank you. All right. Any others?

MEMBER REMPE: Thank you. So let's go on to the next slide, Hossein. And it's the section called integrated assessment observations. And I've grouped them into four topics. And again, I went

through the transcripts and I pretty well tried to just list everything. And so if folks say oh, don't put that in there, Joy. This is a good time to tell me so I don't put it in the draft letter. So I expect some folks to jump in here and tell me some things are bad and get rid of them. Okay?

So the first topic or point I'd like to make in the integrated assessment is that RES is addressing Agency existing and near-term research needs. In our review, I didn't hear that there is a big gap that RES has missed and they need to jump on it right away. We had suggestions here and there, but nothing that was a big ticket item.

I think that some examples to emphasize this might be useful such as I thought what RES has done on the accident tolerant fuel reviews was a good way of using RES resources. They funded and developed some reports related -- reports related to where there are data and modeling gaps. And I would again highlight the fact that some gaps may be difficult to address without a Halden-type capability. And I know we've been briefed on that, but I would still emphasize that it's not clear we're going to get the data like we had data from Halden.

I think that the initiaves are preparing

the Agency for non-LWR reviews. And I expect again, a lot of this will appear in other sections that you know, we can just say it's emphasized in other sections. Again, as I get written in, I will probably not reiterate what we already have discussed. I do think that something about the DRA approach and how we're going to follow on it, might be useful. And with what Vesna has said about that they might want to reconsider the reference plan PRA evaluations, I think that they might be highlighted in this section again. And I emphasize that it is very important as the Agency identifies gaps in models and validation data that they continue to communicate that to DOE and design developers. Anything else from anybody or any comments about deleting some of this?

So let's go to the next slide. Core competencies and capabilities. Again, this I think spans all of the divisions. Every division had acknowledged this is a significant challenge and they are tracking it and are trying to take action to address it as they see it occurring. And I didn't have any suggestions for improving what they're doing, but I thought it would be worthwhile noting that we explored that. And they are doing things that we think are good ideas. And I've listed some of these

ideas on this slide. I think it's interesting that they're taking this integrated university program grants and trying to leverage it for projects that are of interest to the NRC. Okay, not hearing any comments, prior --

(simultaneous speaking)

MEMBER DIMITRIJEVIC: Joy, did we hear -- what I heard from three of us is this is not really necessary connected because -- so I'm not -- there are your specific notes. Right? Because I don't really -- I mean I think we discussed this university problem now previous, right up, you know, two years ago. So is this something -- I mean are we bringing a lot of the same things in this -- I don't remember anybody discussing these problems. Did they discuss those problems?

MEMBER REMPE: In Ray Furstenau's presentation, he mentioned it. And again, it's been a while since I've looked at the slides. But it's my understanding that was something he suggested that he would like to brief -- have his staff brief us on. So we will have an upcoming presentation on that. And Hossein, I believe this was the one that you said you'd like go ahead and start scheduling for us. Right? Hossein, if you're there, you're on mute. We

can't hear you.

MR. NOURBAKHSH: Yes, we have mentioned that. But we have to be at one some point to have that briefing.

MEMBER REMPE: Okay. So that's where it's at, Vesna. Okay? And I guess, you must have had trouble sharing your screen and talking at the same time. So we're going to need you to share your screen again. Sorry.

MEMBER PETTI: So Joy, I had a comment on that slide.

MEMBER REMPE: Okay, this is the slide about the integrated -- the core competencies or the next slide?

MEMBER PETTI: Yeah, yeah. Yeah and it will be -- Well hold on, maybe not. It might be the next slide. The hiring prioritization.

MEMBER REMPE: Uh huh.

MEMBER PETTI: So you know, what many of the national labs do is they kind of try to prime the pump. Right? They have people out giving presentations at the universities because they offer seminar series. I just wonder if NRC could do -- you know, take a page from them. To get them out there so that students think of them as a place to work coming

out of school. It might be that they focus a little bit on that young end of the pipeline.

CHAIR SUNSESRI: There is a grant program that they --

MEMBER PETTI: Right, right. So do they follow up? I mean, you know, do they -- do they go to the university and show interest and develop relationships? That's the thing that is important. Right? I mean so the professor goes oh, I know somebody that might be really good. You know, calls his friend at NRC and says hey, we've got somebody here that would be perfect, that sort of thing.

MEMBER BIER: Yeah, another thing the labs do is offer a lot of the summer internships for students with the understanding that then hey, the student might be interested. And maybe they get a chance to see whether they want that student.

MEMBER PETTI: Yeah.

MEMBER REMPE: Well I know they do offer internships. And I do know that they said that those who have been their university grant recipients get preferential hiring. I don't know about -- We could ask for Ray to speak up and inform further if that's allowed. And now I'm going to need somebody like Scott to tell me no, that's not allowed. The other

thing we could do is just encourage them to increase proactive engagements with the universities early on. And that would be something that would be factually correct no matter what. And we could -- Perhaps Ray would like to speak up and say yeah, we are doing this to some level or something.

(simultaneous speaking)

CHAIR SUNSESRI: Ray has his hand up, so you may call on him. Ray, go ahead.

MEMBER REMPE: Okay. Ray, please.

MR. FURSTENAU: Okay. Yeah, those are really good comments, I think, that we provide scholarships and fellowship grants as part of the university program. There's a program called NRAN, an apprenticeship program that started this past year that drew heavily from the fellowships and scholarship recipients. But we also have -- I know in research we use the intern program and co-op program as well where we get a lot of the early career -- target the early career people. So we do have -- we do have programs that help. Could we use them better? Certainly, I think we could.

On the recruitment, I think, you know, Dave Petti, you mentioned about what the labs do. What we do with I think in turns is certainly not to

the degree as the -- as the national labs. But we do try to get undergraduates and graduate students interested and bring them in during the summers. And then the co-op kind of keeps them on during the year to see if we can get a good fit with a student and what we do. So we do have those programs, but I think we can always do better.

MEMBER REMPE: Does that address Vicki's and Dave's comments?

MEMBER PETTI: Yeah.

MEMBER REMPE: And I've taken notes -- And I've taken notes and I'll try and write the section accordingly. So thank you.

MEMBER PETTI: Thank you.

MEMBER BALLINGER: This is Ron. My experience with seminars from national lab people and things like that is they're very good, but they're technically oriented. And they're not structured in a general sense with the eye of finding somebody that they might want to hire. And most universities have at least two job fairs per year. And I've never seen anybody from the NRC at any of the ones at MIT.

And the other question I might have is -- and I'm sure Ray probably already has somebody doing this, but is there a dedicated person whose job

function is that? Is you know, dealing with seminars and recruiting? Or is it kind of a catches, catch, can kind of thing where you've got a friend that's at a university and you get invited to do a seminar?

CHAIR SUNSESRI: We've got several hands up here.

MEMBER REMPE: Since he asked Ray a question and I think Ray's hand -- maybe it was left over from before, but Ray, did you want to respond?

MEMBER BALLINGER: Let him follow up and then we'll go to the other ones.

MR. FURSTENAU: Yeah, just quickly to follow up to Dr. Ballinger's comment. It is -- It's a little mixed. We have like in our personnel branch -- in our personnel office in charge of the -- you know, a person in charge of recruiting for example and has other job duties as well. But then we do have volunteers, you know, that are maybe graduated from a particular university that will go on job fairs. A lot of those are virtual right now. As a matter of fact, you know, one that comes to mind right now we're going to be participating in is University of Michigan. MIT, I'm not sure. We'd be glad to participate in a job fair for MIT certainly.

But it is kind of a mix of, you know, the

people who have a fondness for a particular university will help recruit people. It is formally participating in job fairs as well. So it's not just one thing.

MR. BURKHART: Yeah, do you have -- do you have follow-through? A lot of times, you know, one contact and you're done doesn't work very well. If you find a contact and you follow through keeping up -- keeping contact with them. Because they start out as a freshman and then, you know, it may take two or three years before they finally ended up having to get a job. But if they have you constantly on their mind, you know, that's a -- it's a longer term, higher payoff thing, I think.

MR. FURSTENAU: Yeah, I agree with that. You know, you have to start early if you want to get the best, I think. I would agree with you.

MEMBER REMPE: Scott, you've had your hand up for quite a while. What's up?

MR. MOORE: Thank you. I agree completely with what Ray just said. We do have a recruiting group within our office; a chief human capital officer. We have people both go out to job fairs at the universities and also job fair from other organizations like the service academies get together.

There's all kinds of job fairs. We also have people that go along with the professional recruiters in OCHCO that as Ray pointed out, have affiliations with those universities.

With regard to the integrated university program, I know for a fact that this past year, they tried to mine that program to see if there would be any good matches between that and the NRAN program. So OCHCO provided names of people within that program to offices to see if they would be interested in some of them. So there was an effort to go -- to match the two.

MEMBER BALLINGER: For example, do you guys have an interface with the Women in Nuclear organization?

MR. MOORE: I'm not sure personally, but I would think so, yeah.

MR. BURKHART: Yeah, this is Larry. So yes, there is all of that. There's a university champion for most of the universities. So there's a very well organized group that interacts with OCHCO. And it's kind of a bridge between OCHCO and universities and technical folks. But I think you make a good point.

MEMBER REMPE: I had my mic on mute.

Luis, do you have your hand up?

MR. BETANCOURT: Yeah, I want to say -- like I have been very active on the area of recruitment. And OCHCO and SPCR, they have a very detailed (indiscernible due to accent) all of the recruitment at the (indiscernible due to accent) that we have in the Agency. And we go off into this cool spin, plus the question from the last meeting is we go through the activities through the (indiscernible due to accent) Service Program. So we know this question that a member has. OCHCO has all of the answers. So I think it would be beneficial, maybe OCHCO can make a presentation to you guys and some other topics. Because all of these topics, they are very involved. And we need to start doing (indiscernible due to accent) of recruiting (indiscernible due to accent) guidance.

MEMBER REMPE: Okay, thank you. Any other comments? Then let's go on to Slide 3. And it highlights our continued interest in the way RES prioritizes research activities and some of the process improvements. And the first one emphasizes their ongoing process to emphasize enterprise risk. And here's where I would like to -- Again, I collected items from various members that were comments in the

transcript. And so if you want to have me delete them, I can. But again, there was one comment that a member made about this code strategy and that code maintenance requires continual support. And it's a sustained support that's required. And it may be something where additional resources may be required.

The other thing is that other projects might be discontinued if it were -- they were subjected to more rigorous evaluations. And one member actually made a comment about maybe that user needs should have a fixed end date and require revisions to reflect redirection after the original objectives are achieved.

I'm going to stop here. Are members okay with something like this to be put in our integrated assessment section or you want me to delete some of these items? Okay, not hearing any comments, we'll go forward with it then.

The second bullet just emphasizes some of the process improvements we've seen happen within RES. They are trying with the reg guides to have more interactions with industry to emphasize which ones should get updates. They have developed a risk app for resident inspectors. So they're making use of their risk insights. And then of course there's been

a lot of increased use of the virtual platforms. And I've been very impressed with some of the seminars that I was able to participate in, in the last six months such as the source term results that DSA has presented. And it's been helpful for me to understand some of the non-LWR technologies. And they're there for the staff, as well as the public. And it's been a nice thing to have where you can't always (audio interference) at NRC.

And then the last item I wanted to emphasize is on slide -- the next slide. And it actually spans two slides. So if you'll go to Slide 33 -- and you may already be there, but my -- oh, my screen just updated.

Anyway, I think it's been interesting to see RES try and take on some projects for the whole agency. They have taken on this data science AI implementation effort again. And they are not only looking at outside organizations, but inside organizations to develop an agency-wide strategy.

With respect to the future focused research projects, I'd like to add here the recommendation that Matt suggested. But also that they're taking some of these FFRs and making them in -- they're proposing that the FFR effort become a

sustained R&D program to improve the agency knowledge on some key topics. And during our discussion on the FFRs, we recommended that they consider having an annual status report. And I know after the meeting I received what they provide to the commissioners and it's just a list. And what we were thinking of is just a highlight of what the FFR program has accomplished might be a good idea to include as a recommendation. Okay? Everyone understand what I'm saying there?

CHAIR SUNSESRI: Yeah, I do but --

(simultaneous speaking)

MEMBER REMPE: Okay, then if you'll go to the next slide.

(simultaneous speaking)

MEMBER REMPE: Sorry, I heard a comment?

CHAIR SUNSESRI: Yeah, yeah. This is Matt. I want to ask Joy about the annual report. So what are they doing? I mean I don't really know what they're doing for the rest of their stuff. I mean, you know, would this be separate from however they report the results of all their research?

(simultaneous speaking)

MEMBER REMPE: Yeah --

(simultaneous speaking)

MEMBER REMPE: -- this research report. And it talks about all the research projects. But what I'm thinking of is a short -- not a 50-page report, but a short brochure that says, "Future focused research projects". And not just talking about what they are, but some of the accomplishments of what they've learned and done with the funding. Because this is -- you know, most of the research projects are still user needs -- user need instigated. And this is something where they are taking on research-instigated projects, right, or initiated projects. Does that sound good? And again, if you think they shouldn't do that, this is the time to tell me and I'll take that recommendation off.

CHAIR SUNSESRI: Well, I'd like to see -- Well, I don't know. It's fine, I guess. You know, I just -- I worry about creating unnecessary work. If they have something that is similar that they could, you know, add this to it or make it a focus or whatever. You know, any time you're asking somebody to create a report, it just sounds like well what's the value of this going to be? What's the goal? You know, how does that fit in with their performance model, things like that.

MEMBER PETTI: You know, you could also

think about like a one pager. I know that at the labs -- the internal R&D, sometimes they just do sort of a simple one pager to give you a sense of where it is. So it wouldn't take a tremendous amount of effort and it's all there together.

MEMBER REMPE: I think that's what the intent was with that recommendation. A short bulletin, like one or two page bulletin of highlighting it. Because a list of -- I don't remember now if it was ten projects that they send to the commissioner or if it's just the topic -- the headings or the title of the projects. And instead, you know, what does it accomplish? You know, that's what -- I'll light it up as a short bulletin highlighting accomplishments. Okay?

CHAIR SUNSESRI: Yeah, that's fine. I mean I just think about, you know, when we think about asking staff or whatever to come to us and make a presentation on that, we had one idea of what the effort goes into that. And I think they put in way more effort into it than what we think. So just as long we can avoid that they don't go overboard -- You know, creating a whole bunch of work to address to address this recommendation, I'm fine with it.

MEMBER REMPE: Okay. When it was

suggested to the staff -- and again, maybe they just wanted to say something and move on -- but the staff in the transcript said they thought that would be a good idea and they weren't aware of any such document. And I can't remember now if it was Dennis or which member asked if they had such a bulletin. Okay?

MEMBER HALNON: Joy, just real quick. This is Greg. You've just go to be careful. I hate to be the negative, but unintended consequences of putting out headlines or partial information on projects and it's effect on the potential of the nuclear industry relative to the folks that might use that and expound on it in a way that research is not going to be able to answer. So I don't know if I'm saying that correctly. I'm trying to be politically correct, but you've just got to be careful with the headlines of future projects that people could use in a toxic way.

MEMBER REMPE: Well, we could take this off and not recommend it. You know, again that's why I'm discussing it today to try and make the letter writing go better.

MEMBER HALNON: I think the benefits are good. And I think the staff just needs to be cautioned not to say things in such a way that

somebody can misconstrue them into a safety issue or some ongoing issue that could be used in an inappropriate way. It may be appropriate to have a conversation about it, but not necessarily expound on unfactual things that could cause problems. So I just think that the staff needs to be aware and careful on how they characterize these future projects.

MEMBER BLEY: I kind of get where Greg's coming from. But I like Dave's comment and I've been associated with organizations that require this one pager. But often it's like a slide broken into four pieces. And then you can get enough information down that it's not going to get misinterpreted badly the way it could. But you give a real quick summary of where it's headed. So maybe some of us could find examples of those from other places that would be helpful to pass onto the staff.

MEMBER HALNON: Well, I think the staff is well equipped to do it. I just wanted to make sure that caution was out there that it's important on how you put it across. Not as -- just avoid the unintended consequences of a headline.

MEMBER BLEY: Yeah. We've heard quite a few years -- we've mentioned the work that the fire protection guys have done to promote their research

and usually that's done pretty nicely. So there are some good examples from that, that other people could look at.

MEMBER HALNON: Yeah, HEAF didn't go over it that well though initially. I mean it was pretty tense for a while.

MEMBER BLEY: Well that's true and it got zeroed out at one point too.

MEMBER HALNON: Right. Just a caution there and it doesn't even need to be in the recommendation, but I just felt compelled to say something.

MEMBER REMPE: So a couple of hands up. But first of all, as I write this up, what would be a nice way of doing this is to say "We suggest they consider a short bulletin to highlight accomplishments similar to" -- And if somebody will send me some good examples, I'll point them that direction.

And so then I saw Vicki's hand and I thought I saw Ray's hand. So Vicki, you go first. Then I'll see if Ray's hand is still up.

MEMBER BIER: I just wanted to mention that communicating for public consumption in this kind of headline mode is kind of a whole different skill than technical communication, you know, peer to peer

to be read by other engineers or whatever. And so I'm kind of sensitive to Greg's issues about if we encourage people to do a lot more publicity of their work, they also have to have editorial support and et cetera to make sure that it's done well. And I know NRC has that internally, but it needs to be looped in, in any publicity that they do.

MEMBER REMPE: Okay, thank you. And Ray, did you have a comment?

MR. FURSTENAU: Yeah. I think the -- I've been taking in the comments from Greg and Dennis and others about how to present this. You know, we intended to the periodicity I haven't decided yet. Okay, here's this future focused research program that started in FY20. Here's what it's -- you know, what it's done for us. These are certainly like I user need that could go on for several years and have multiple reports. These are kind of investigative things.

You know, it's kind of like a -- I hate to compare it to LDRD, but it's LDRD very, very light, you know, from a regulatory standpoint. So we do intend to show okay, this new program's been supported. I think we owe it to the commission to say okay, you supported this. Now here's what we see

coming out of it as a whole. We're not quite sure exactly how to do it yet, but it was good for me to listen to the comments and cautions that you folks have. So thank you for that. So we do intend to do some sort of an accomplishment report.

MEMBER REMPE: Okay. So again, if someone will send me some good examples, I'll cite them in the letter and we'll include them in our reference list. Okay?

MEMBER BLEY: Well one thing we've seen a lot of in the last three or four months is NRR's, what do they call it, Venture Studio. And they've been turning out some really first rate presentation material and graphics and that sort of thing. And I'd hope if you guys over in research are following that pretty closely because they could be a big help to you.

MEMBER REMPE: Okay, that's a good point. And I am aware of the EMBARK Studio folks and what they've been putting out.

Okay, so then on slide -- the next slide, which is 34. I was going to mention again the Agency's code investment plan. And I guess this is where I planned to talk about the substantial and sustained research efforts to address these emerging

technologies and code maintenance needs, and additional resources may be needed. And that's the way -- Again, I'm not recommending additional resources. I just am commenting as a member did during the discussion that additional resources may be needed.

And I didn't like to say that we're going to have some additional briefings that we plan on. And I guess I didn't get to the list until I was trying to draft up the slides for the conclusions and recommendations. But I probably would list it in this section. But if we go on to the last slide, I've got that list and I'd like input if I've missed any topics. Or if we could possibly prioritize that very long list, it would be good to do that today so Hossein and I know where to go on the future briefings.

But anyway, I'm not hearing any big changes in my integrated action plan. So I'd like to go ahead and go through what I think might be good conclusions and recommendations to have at the beginning of our report. And again, starting off -- which I think this has been a conclusion from our last -- I don't know how many biannual reports -- but we continue to say that the current RES activities are meeting the Agency's current and near-term needs.

And that we do continue to support the fact that they are using a systematic approach to prioritize research, project selection, evaluation and determination. And the importance of international, as well as domestic collaborations. And then this thing about the extend dates that we -- I discussed earlier and noone told me to take it off.

And then if you go on to the next slide, Hossein. I was going to emphasize about the RES initiatives to address longer term agency research needs and comment about the FFRs and the strategies. The integrated code maintenance and development plan and the ongoing efforts to emerging technologies. And I think I've got some words that are repetitive and I'll try and work on that in the next month here. But I was going to comment additional agency resources may be required in the conclusions and recommendations.

And then in this next slide, which is Slide 37, I wanted to go through our additional briefings that we're planning, as well as the episodic reviews that we will continue going through. And so I guess, let's go to the list of additional briefings. I think we've heard from the staff. They'd like to kind of give us an update on the Future Focused Research projects, as well as the Integrated

University Program. Then during the discussions, these other items came up like this safety and design. It may be taken care of through the Part 53 discussion that Dave's going to have in the next month or so. But are there any other items that we'd like to be briefed on? Or was there something that you don't want to hear about? Because that's a lot of briefings.

MEMBER PETTI: Well yeah, I'm a little confused. I mean we could talk about, you know, as part of the source term briefing, they're going to brief us on the RES contractors and their work on calculating source term. It will be done under Part 53, but I don't think that -- that matters necessarily.

MEMBER REMPE: So put down the reference plant source term evaluations? Is that --

MEMBER PETTI: Something like that, yeah. Or source term calculations.

MEMBER REMPE: I apologize, but I'm typing and I'm sure you're going to hear it, but I'm hoping not. And I -- When I write this up in the integrated action section -- assessment section, I'll mention that some of these are being covered other places. And the conclusion will just have -- we have additional briefings. But it's good to get this list

agreed upon. Anything else, folks?

(simultaneous speaking)

CHAIR SUNSESRI: You have some hands up.

MALE PARTICIPANT: Yeah. There's several hands up, Joy.

MEMBER REMPE: Okay. Is there any member first? Okay, so I see Mark.

MR. THAGGARD: Yeah. I just wanted to provide some clarification if I could about the safety and design, the EPRI report. We're not planning to use that report to replace looking at the reference designs or anything like that. Our intent on that report was simply -- our initial effort was we would -- we were planning to do -- to develop a PRA model for one of the designs. And we picked out a particular design that we wanted to develop a PRA model on just to see what was the data gaps.

Then you've got the EPRI and Vanderbilt was doing something similar. So under our MOU with EPRI, we decided we'll just follow and see what they're doing to see what kind of conclusions that came out of it. That was really the only intent of that effort. It was not to -- There was no intent to use that to the plant, looking at -- you know, different type of plant designs or reference of the

plant designs or anything of that nature.

So I just wanted to make sure, you know, I was clear on that. We have right now very little involvement with the whole graded PRA approach. We do have a staff member's that participating in it. But that effort is being led out of NRR and we're providing them support on it. But they currently have the lead on it.

MEMBER REMPE: So I'm confused because Vesna said she didn't -- her understanding is consistent with yours. But when I looked at the transcript and when I recall the discussion, I did not hear that you have any plans -- and now even today, you're saying NRR will do a reference plant evaluation, instead of Research. Whereas research did reference plant evaluations via saved it for the source term. How will NRR do a reference plant evaluation? And why are they doing it, instead of Research?

MR. THAGGARD: I don't know that NRR is doing that. I didn't say that. What I said is that they have the lead for developing this approach for a graded PRA. They've taken the lead on that. We're supporting them on that. I don't know that anybody is right now developing a graded approach -- developing

a PRA for reference. That work is not being done as far as I know.

MEMBER REMPE: So two years ago, we were told by your predecessor that they were going to try and do reference plant PRAs. And you're saying now, are you going to or are you not?

MR. THAGGARD: I will have to go back and double check what was conveyed in that, Joy, because that wasn't my understanding. But you know --

MEMBER REMPE: So the answer is right now, you do not intend to or you do intend to?

MR. THAGGARD: No, we do not. We do not intend to. That's not in our current plans.

MEMBER REMPE: So if we were -- again, I don't know when we're doing the final letter -- but if ACRS would say -- provide a recommendation saying that we suggest that DRA consider reference plant PRAs, that would be something different. Because right now, I'm hearing you're not considering it. Right?

MR. THAGGARD: That would be -- That would be -- You're correct. We're not considering that right now.

MEMBER REMPE: Okay.

MEMBER PETTI: So Joy, I don't know how we can tie this stuff together. Because when you get into

this graded approach for PRA, it gets a little ethereal. And a recommendation of a use case, you know -- you know, to take it out and see if it actually works, that's done a lot. Right? I mean they did that for LMP. And so maybe, you know, we could wrap that idea together with the graded approach to PRA.

MEMBER REMPE: Okay, this helps. And then Tim, you had --

MEMBER PETTI: You know, a PRA of a larger design is a really a large exercise. But if these graded approaches are simpler, then it implies that it wouldn't be as much strain on resources to be able to -- you know, to take it out and see if it actually works.

MEMBER REMPE: Okay. So I'll put this in the notes and we'll cogitate on how to do this or to write it up. Kim, your hand's been up for a while.

MS. WEBBER: Yeah. Just a quick clarification on the advanced reactor source term work. Were you thinking about having a meeting that's in context of the everything source term February ACRS meeting or separate from that?

MEMBER PETTI: No, when I talked to (inaudible) NRR -- we were talking about doing it all in that.

MS. WEBBER: Yeah.

(simultaneous speaking)

MEMBER PETTI: Wrap it all together.

MS. WEBBER: Yeah, that's what I thought my understanding was too. That's why I wanted to just double check.

MEMBER PETTI: Yep.

MS. WEBBER: Okay, thanks.

MEMBER REMPE: Are there any other items you want to add to this first bullet on possible briefings?

Okay, so then the second bullet is a bit more straight forward, I think. That we're going to continue episodic reviews on activities. I would offer up that the non-LWR, it would be done something done under Part 53. You know, but we continue to follow these items. And the Reg Guide 1.247 is actually done, so I guess I'll take it off the list because it wasn't done at the time when I generated this slide. Is there anything else I should be adding or taking off?

CHAIR SUNSESRI: I know that it's a low priority.

MEMBER REMPE: The research folks, so do you want me to just take it off? And then it will be

done as part of the research. I know that actually during the subcommittee on this topic, I almost thought it was Mark, but maybe it was a different -- maybe it was Mark Salley. But anyway, I thought they said they would like to come back and brief us on it. But do you want to have that taken off?

CHAIR SUNSESRI: I just said make it a low priority. It's like number two on the list. I'd move it to the bottom.

MEMBER REMPE: Okay, so I -- the list wasn't meant to be prioritized, but I will move it just right now since I'm doing that.

CHAIR SUNSESRI: I think Mark wants to comment.

CHAIR SUNSESRI: Sure. Mark?

MR. THAGGARD: No, I was just going to respond. So we are developing a number of reports -- highly technical reports that we should be finished with next year. (audio interference) -- I think there might be a desire to come back and brief the committee on those reports because it's somewhat groundbreaking in terms of how to analyze this HEAF events.

MEMBER REMPE: And I'm guessing again, if we can accommodate it, we would like to hear about it. Okay and so then there's just this last bullet about

-- and I'm not sure that's needed in the letter, but we do continue to provide letter reports as needed. It doesn't mean that there will be any letter reporting on any of the above items. But if something happens that we think is noteworthy, we would write a letter report or if the staff requests one.

MEMBER PETTI: So Joy, the digital I&C IAP, that's an NRR letter activity.

MEMBER REMPE: Okay, so is that on?

MEMBER PETTI: No, it's not on the list. I mean it shouldn't be if it's not an RES activity. I think it's an NRR activity. I'm just trying to --

(simultaneous speaking)

MEMBER REMPE: You know, when Charlie had his meeting two weeks ago, it was I think the NRR folks who were doing it. But it kind of spans -- sometimes there's research folks that are involved in it too. So should I add it or should I not? Because I mean some of these things kind of cross boundaries, but it's up to you. I could add it in or leave it off.

CHAIR SUNSESRI: I don't think there's a need to add it. We have plenty of interaction on the Digital I&C already, so I mean, yeah.

MEMBER REMPE: And that's it. And I'm

amazed we got through this with only being 15 minutes over. Thank you for extending our schedule, Matt.

CHAIR SUNSESRI: All right. Well it was important to get through this because then it unleashes the letter preparation now. So we can go forward with some pretty solid backing on putting together a good draft for the committee to review downstream. So thank you members for your indulgence here.

What I'd like to do for the rest of the day is take a short break here. We'll take a 15 minute break and then reconvene at 4:30. And then we will pick up the letter report from the -- on non-light water PRA standard. And then I suggest we call it a day and then we will pick up tomorrow with the dry run, the Commission briefing, and that's all we have for this week. So we can talk about that more after the letter report today. So we are recessed until 4:30. And at 4:30, we will reconvene on the letter report for the non-light water reactor PRA standard. Thanks. Did I say "adjourn"? I mean "recess."

(Whereupon, the foregoing matter went off the record at 4:15 p.m. and went back on the record at 4:30 p.m.)

ACRS Research Review – Annotated Report Outline

ACRS Safety Research Subcommittee

OUTLINE

- Background
- Division of Risk Analysis
- Division of System Analysis
- Division of Engineering
- Integrated Assessment
- Conclusions & Recommendations

Background

- The Office of Regulatory Research (RES) supports the NRC's mission by providing technical advice, tools, and information to help resolve safety and security issues, make regulatory decisions, and promulgate regulations and regulatory guidance.
- RES activities include conducting confirmatory analyses, developing technical bases to support safety decisions, and preparing the agency for new technology safety evaluations. These activities also enhance agency technical expertise, build staff competencies, and facilitate transformation.

Background (continued)

- Our biennial review addresses 1997 Commission guidance:
  - Examine need, scope, and balance of the reactor safety research program.
  - Evaluate the progress of on-going activities to meet agency needs
  - Consider how well RES anticipates research needs and how it is positioned for the changing environment
- Our letter report emphasizes several RES program aspects:
  - Ability to meet current and near-term agency needs (including competencies and capabilities)
  - Prioritization of new research projects
  - Long-term planning
  - Response to our prior recommendations and planned future interactions

Background (continued)

- 2022 biennial report developed using insights from:
  - Initial meeting with RES Director to obtain overview of program, plans, priorities, and areas of interest
  - Three working group meetings to discuss research conducted by each RES division: Division of Risk Analysis (DRA), Division of System Analysis (DSA), and Division of Engineering (DE)
  - Other briefings:
    - Future focused program update
    - Halden gap briefing
    - Episodic reviews (IDHEAS, Non-LWRs IAPs, DI&C IAP, Level 3 PRA, etc.)

DRA Overview

- It is a prominent agency resource on all risk-related matters
- Maintain and enhance tools & methods to perform risk evaluations which support the agency's solutions to current and anticipated regulatory challenges.
- Organized in four branches: Probabilistic Risk Assessment Branch, Fire and External Hazards Branch, Performance and Reliability Branch, Human Factors and Reliability Branch.
- Main Objectives:
  - Grow the agency's RIDM capabilities
  - Be ready for future technologies
  - Completion of high-quality research products
  - Facilitate Transformation
  - Build and enhance staff capacity

Highlights and Observations (1/11)

Performance and Reliability Branch (PRB) Projects and Future Work

- **RIDM and PRA Guidance and Standards, Future Direction:** Support issuance of L1/LERF, ALWR, Level 2, Level 3, LPSD PRA Standards, and Regulatory Guidance on PRA Acceptability (Issue RG 1.247), *Enhance guidance on the treatment of uncertainty, Develop guidance on RIDM and on uses of non-PRA techniques, Develop a database of PRA standards and methods*
- **Data Collection and Analytics:** Directs the reviews and evaluations of OpE Information for the purpose of maintaining and updating models used in risk-informed decision-making
- **PRB3: ASP Program (Accident Sequence Precursors):** Evaluates U.S. NPP operating experience to identify, document, and rank operational events

Highlights and Observations (2/11)

Probabilistic Risk Assessment Branch (PRAB) Projects and Future Work

- **SAPHIRE and SPAR Models Future Directions:** SAPHIRE & SPAR Improvements, Expanding and Enhancing SPAR Model Scope, Cloud-based SAPHIRE, Application of IDHEAS-ECA
- **Level 3 PRA Future Direction:** Public Release of Reports, Knowledge Management and Risk Tool to Support Regulatory Decision-making, Using L3 PRA to support licensing advanced reactors
- **Dynamic PRA Future Direction: D**ocument model result (final report), Workshops/Training, Support Changing Environment

Highlights and Observations (3/11)

Fire and External Hazards Analysis Branch (FXHAB) Projects and Future Work

- **Improving Fire PRA Realism Future Directions:** Working with EPRI to advance and improve the realism
- **High Energy Arcing Faults (HEAF) Future Direction:** Exiting the Pre-GI 018 Aluminum HEAF and transferring back to research, working with EPRI, OECD/NEA to advance and understanding of the risk posed by HEAFs,
- **Probabilistic Flood Hazard Assessment (PFHA) Future Direction:** Pilot studies will be completed in 2022 and regulatory guidance will be completed in 2023
- **Subsurface Characterization and Waste Covers:** A New area develop to primarily support NMSS related environmental projects by providing expertise in the area of environmental hazard analysis including subsurface monitoring, radon barriers and evapotranspiration (ET) covers

Highlights and Observations (4/11)

Human Factors and Reliability Branch (HFRB) Projects and Future Work

- **Advanced Human Factors, Human Factors Licensing Review Guidance Updates Future Direction:** Part 53 Scalable HFE Review Guidance and Part 53 Scalable Operator Reactor Licensing Requirements
- **Organizational Factors, Agency Innovation and Culture Change Future Directions:** Utilize organizational factors expertise to drive innovation and culture change at the NRC, Enhance capabilities to perform external crowd sourcing for significant tech challenges
- **Human Reliability Analysis, Human Reliability Analysis Methods and Data Future Direction:** IDHEAS testing in NMSS Applications, Dependency/Recovery, Minimum Joint Human Error Probabilities, Uncertainty, More plant participants, International HRA Data Exchange

Highlights and Observations (5/11)

Key Core Competencies

- One of the objectives of the division is to build and enhance staff core competencies
- Shortage in core positions (reliability and risk engineers) over the next five years is anticipated due to retirements.
- Strategy to address this need includes hiring and training staff, rotational assignments, and staff developmental assignments:
  - Hiring entry level staff provides an opportunity to develop the competencies of greatest need.
  - Cross training staff across branches provides a greater flexibility in handling staff losses
  - Currently there is an effort to find ways to train non-human factors experts from different fields to become experts in licensing reviews of human factors issues. A training program is being developed and expected to be completed in the October. There is a plan to share materials from that training internationally through the Nuclear Energy Agency.

Highlights and Observations (6/11)

Collaborations

DRA leverage resources and skills through collaborating with others. Some of the current collaboration efforts, both international and domestic, are highlighted below, showing benefits from these interactions:

- Participation in the risk, external events, and human and organizational factors CSNI working groups with NEA. In particular, the working group on risk is currently working on an effort to look at PRA uncertainties, which could be useful in the support for advanced reactors.
- Bilateral arrangement with France's IRSN to collaborate on flood risk modeling where they are sharing some of their modeling capabilities on riverine floods and storm surges.
- Exchanging human performance data with the Czech Republic and South Korea to expand human performance database.
- Recently signed agreement to participate in a newly formed Halden project, looking at operator performance in digital control rooms, human performance in operation of small modular reactors, operator performance in highly automated plants, and the effects of adaptive automation on operator performance.
- EPRI and NIST have provided a lot of technical expertise and modeling support for our work on the aluminum HEAF issue.

Highlights and Observations (7/11)

Sunsetting Projects

Objective is **to complete several research projects, which include:**

- Aluminum Heat Issue (HEAF),
- Level 3 PRA Project, and
- Probabilistic Flood Hazard Assessment Project.

However, the work will continue in two of these projects:

- **Level 3 PRA Project -** There is an effort to leverage insights from the Level 3 PRA work to support licensing advanced reactors. For example, the Level 3 PRA Project is expected to provide insights on assessing the risks from multi unit sights and integrated site risks which could prove useful for licensing small modular reactors.
- **HEAF** project - Generic issue program has been exited, "not coming to a resolution in a timely manner". The project is still ongoing: working with EPRI, OECD/NEA to advance and understanding of the risk posed by HEAFs, there are deliverables that will be coming due in FY22.

Highlights and Observations (8/11)

Future-Focused Research Project: Advanced Reactor Program

The advanced reactor program has picked up recently and is expected to increase over the next couple of years. Currently it includes:

- Developing PRA guidance that will be needed to support licensing non-light water reactors. This includes developing guidance to address PRA uncertainty (an important issue for non-light water reactors where we don't have operating experience).
- Conducting research on a graded approach to scale and target human factor engineering reviews for small and microreactors. This includes developing human factor engineering review criteria.
- Developing technology inclusive operator training and examination requirements.
- Future-focused research project on the use of dynamic PRAs which may have application for advanced reactors
- What about their decision to rely on EPRI/Vanderbilt University approach for SiD (using PHA); are there any gaps such as transportation of a module with a loaded core; spent fuel modules, etc., not being addressed?; how will MCA be identified?, expand efforts to develop potential non-LWR risk metrics; apparently, there is a SNL database for SFRs, do other labs have such databases? Are insights being communicated to those doing Part 53?)

Highlights and Observations (9/11)

Facilitate Transformation Innovation Activities

- DRA has an important role in the Agency's transformation effort through:
  - Overseeing the innovation activities (Innovate NRC 2.0), or
  - IDHEAS scale software.
- DRA is one of two places in the agency that has organizational factor specialists. There are some in the Office of Chief Human Capitol Officer (OCHCO), and the rest are in the Office of Nuclear Regulator Research.
- When "the big push" in innovation started, multiple staff members in HFRB move into the EDOs office in a technical support role. They helped build the Innovate NRC 2.0. program. That includes infrastructure and the procedures and processes for maintaining and sustaining innovation.

Highlights and Observations (10/11)

"Innovative" Projects

- **Dynamic PRA** refers to PRA approaches that simulate system behavior and accident scenario development over time. As a supplement to commonly used event tree or fault tree methods, the use of dynamic PRA has the potential to provide additional useful risk insights for both advanced designs and operating plant designs and operations. The final report documenting dynamic PRA model results is expected in July 2022.
- Limited work on **artificial intelligence** that includes a scope and assessment of AI use within the industry. DRA recently signed a MOU with DOE to work with them on sharing information and insights on the use of AI techniques for analyzing operational data.
- Possible future projects:.
  - Effects of extreme weather events.
  - Security area, support in the physical security area.

Highlights and Observations (11/11)

Dry Cask Storage Licensing Fuel Storage and Transportation Business

DRA is currently looking to expand their support to NMSS in areas of dry cask storage licensing, the spent fuel storage, and transportation, and decommissioning of low-level waste business lines, by

- Developing risk tools for dry cask storage licensing reviews,
- Providing environmental support for the decommissioning program,
- Developing risk tools to help scope future reviews of transportation packages,
- Developing risk tools for spent fuel dry storage - this work is nearly complete; a report was published last year. Additional support will be provided to NMSS during the implementation phase.

DRA Conclusions and Recommendations (1 of 2)

- DRA is sunsetting some projects and finding a new role for ongoing projects, for example using L3 PRA to support licensing advanced reactors, developing Part 53 scalable HFE review guidance and Part 53 scalable Operator Reactor Licensing Requirements. *We strongly support such utilization of already performed work.*
- DRA has a new and important role in the agency's transformation effort through overseeing the innovation activities by utilizing organizational factors expertise to drive innovation and culture change at the NRC. That includes building infrastructure, the procedures and processes for maintaining and sustaining innovation. *We support this substantial effort, but in this time we do not have enough information to evaluate how is being coordinated, and what have been accomplished*.

DRA Conclusions and Recommendations (2 of 2)

- DRA is investing an effort to develop guidance to address PRA uncertainties, in both, Regulatory Guidance on PRA Acceptability and HRA efforts. *We strongly support this effort, because there is a clear need for guidance how to utilize uncertainty results in the regulation. That is an especially important issue for advanced reactors, with new design features, where operating data are not available, and the modeling experience is somewhat limited.*
- DRA has a few new projects in the process: Dynamic PRA, support NMSS related environmental projects by providing expertise in the area of environmental hazard analysis including subsurface monitoring, radon barriers and evapotranspiration (ET) covers. DRA is also considering possible future projects: analyzing effects of extreme weather events, support in the physical security area. *While we can see a need for these projects, we notice lack of the project to support advanced reactors. Currently, more than 80% of DRA work is in the operating reactors business line, and less then 10% in advanced reactors. We would like to see these percentage changing in the upcoming years.* *[this ties to my comments on Slide 15]*

DSA Overview

- DSA plans, develops, and manages research programs to develop and maintain broad technol expertise, experimental data, computer codes, and knowledge needed to support
- DSA develops and maintains a wide spectrum of systems analysis computer codes that are state-of-the-practice and/or near state-of the-art to support regulatory user and licensing needs
- Organized into four branches: Accident Analysis, Code and Reactor Analysis, Fuel and Source Term Code Development, and Radiation Protection
- Core competencies include neutronics and reactor physics, thermal hydraulics, fuel performance, severe accidents, source term and radiation health effects
- Developing competencies include advanced reactor behavior, data science and artificial intelligence

Activities to Address Prior ACRS Recommendations

- Staff implementation of non-LWR code IAPs:
  - Emphasizing simplified solutions for estimating source terms
  - Primarily focused on developing /maintaining in-house codes, capabilities, and expertise
  - Non-LWR reference plant evaluations to assess modeling capabilities and data gaps
- Staff developing longer-term (5 to 7 years, rather than 3 year) strategy for code maintenance, consolidation, and development, considering needs for emerging technologies (e.g., ATF)

Findings

- The breadth and depth of the capabilities in DSA are critical to providing the technical basis for reasonable assurance of adequate protection related to the safety of reactor designs as part of the overall licensing process.
- Numerous international collaborations used in the Division to leverage experimental capabilities around the world. These capabilities would cost the NRC hundreds of millions of dollars to replicate in the US. The codes used by all the groups have a large international set of users which is a testament to the quality and value of the DSA products to the international reactor safety community.

Findings

- The balancing of current needs and future needs (accident tolerant fuel, high burnup fuel, and advanced reactor applications) in the current ever evolving reactor technology environment is admirable.
- Preparation for advanced reactor applications is coming along well across a range of anticipated reactor technologies. More results are expected next year.
  - The Reference Plant Evaluations have helped identify data gaps, prioritize data needs and establish the adequacy of confirmatory tools.
  - Recent DOE funding awards have helped NRC prioritize its research activities.
  - This balancing is critical to performing “the right research at the right time.”

Findings

- The code investment strategy is sound. The process is a holistic assessment focused on key needs over a longer time period (5-7 years) to have the greatest impact to the agency.
- The new agency-wide data science and artificial intelligence initiative is a worthwhile endeavor. Good definitions, standards and use cases are critical to its value to NRC. The impact on reactor safety (e.g., autonomous control, vulnerability assessments) needs to be established. Getting started on this work early is laudable.

DE Overview

- Plans, develops, and directs safety research technology and engineering programs and standards development to enable the agency to become a modern, risk-informed regulator
- Organized in five branches: Regulatory Guide and Programs Management, Reactor Engineering, Materials Engineering, Instrumentation, Controls, and Electrical Engineering, Structural, Geotechnical, and Seismic Engineering

DE Overview (continued)

- Maintains competencies in the following core and developing areas:
  - Metallurgy, NDE methods, physical chemistry and materials science
  - High temperature materials performance, design methodologies, component performance, molten salt fuel cycle, material safeguards and physical security
  - Development, maintenance and deployment of advanced software tools
  - Project management of cross-cutting technical projects
  - Instrumentation, controls and electrical engineering
  - Structural, geotechnical and seismic engineering, including seismology and geophysics

Activities to Address Prior ACRS Recommendations

- Increase external engagement, including non-nuclear expertise, to prepare for emerging technologies, such as Advanced Manufacturing Technologies (AMT) and big data
- Progress to address Halden Gap (we had a briefing, but long lead times required to obtain data with limited facilities; need to publicize identified data needs)
- Progress related to on-going efforts:
  - DI&C IAP – we continue to review and provide comments on progress
  - Project sunsetting – (the branch continues to evaluate and sunset projects at appropriate conclusion, for example Embedded Digital Device research)

DE Highlights and Observations

- Possible topics/questions:
  - Digital Twins current focus & recommendations
  - AMT focus & recommendations
  - Harvesting (expensive, is benefit appropriate? Noted that some activities in international programs were to emphasize areas of less interest to NRC)
  - Successes
    - Process improvements for RG updates, standard endorsement, and GSI closeout: Several key RGs issued or in-process (PFM, non-LWRs standards endorsements, such as HTGR components, PRA standard, etc.) Should we note that we support this effort and encourage early interactions with ACRS to increase effectiveness?
  - Project termination (PWSCC, cable aging, irradiation effects on concrete, and NDE – programs have accomplished much, but continue; perhaps termination or refocus needed? For example, NDE may need to be refocused to enable AMT?)
  - Future meetings? AI, AMT, Digital Twins, Materials Harvesting, RIPB Seismic Design?

DE Conclusions and Recommendations

We continued to be interested in:

- the development of Advance Manufacturing Technology in particular defining quality assurance requirements for safety related applications
- the progress and viability of Risk Informed Performance-based Seismic Design
- the development of Digital Twinning and lessons learned applied from years of simulation experience
- use of Material Harvesting to create prediction modeling capability versus using empirical data
- effectiveness and lessons learned from Future Focused Research process experience

Integrated Assessment Observations (1 of 5)

RES addressing **Agency** existing and near-term research needs

- Programs provide data and analyses required for regulatory decision-making
- Results facilitating ATF reviews
  - PIRT completed to identify data and modeling gaps
  - Some data gaps may be difficult to address without Halden-type capabilities
- Initiatives preparing agency for anticipated non-LWR reviews
  - Advanced Reactor Code IAPs enable independent non-LWR analyses and identify technical "gaps" in capabilities and data
  - DSA reference plant evaluations providing confidence about adequacy of selected computational tools and identifying data gaps; *Something about the DRA approach to rely on the Vanderbilt MSR SiD evaluation.*
- Important that gaps in models and validation data be communicated to DOE and design developers

Integrated Assessment Observations (2 of 5)

Core Competencies and Capabilities

- Recognized as significant challenge (affected ability to complete several projects such as Level 3 PRA and HEAF and to start new ones)
- RES divisions track current and pending core competencies and capability gaps
- Several actions being taken to address capability gaps
  - Access to high-performance computing through DOE laboratories
  - International collaborations established to address some Halden gaps
- RES employing methods to maintain /develop core competencies
  - Hiring prioritization
  - Virtual /in-person assignments and staff cross-training
  - Strategic partnerships to develop competencies in emerging fields (domestic and international)
  - Integrated University Program R&D Grants/ Leveraging university grants to emphasize areas of interest to RES; ACRS briefing planned on Integrated University Projects (IUPs)

Integrated Assessment Observations (3 of 5)

Prioritization and Process Improvements

- RES with input from other offices use systematic approach, emphasizing 'enterprise risk' for research project selection, evaluation, and termination
  - Many efforts, such as code maintenance, require continual support
  - Other projects, such as concentrated efforts to obtain data to support regulatory decisions, may be discontinued or redirected, if subjected to more rigorous evaluations.
  - We recommend that user-needs have a fixed end-date; revisions required to reflect redirection after original objectives achieved
- RES implemented several effective process improvements
  - Increased interactions with industry to emphasize prioritization of RG updates, GI closeouts, and consensus standard endorsements
  - Risk app for resident inspectors
  - Increased use of virtual platforms for RES agency seminars

Integrated Assessment Observations (4 of 5)

Efforts to Address Long-term **Agency** Research Needs

- Preparing to review New Technologies that enable Fleet Modernization
  - Data Science/ Artificial Intelligence (AI) Implementation:
    - DSA leading effort to develop agency strategy
    - Fostering partnerships with other domestic organizations (DOE, DoD, NIST, EPRI, IEEE, NASA, ASME, etc.) and international organizations (OECD, IAEA, JAEA, KINS, GRS, etc.)
  - Future Focused Research Projects:
    - DE managing to prepare agency for innovative technologies
    - We support the goal of having FFR becoming a sustained R&D program to improve agency knowledge on key topics (e.g., Digital Twins, AMT, AI, etc.)
    - Recommend project accomplishments of FFR be published annually

Integrated Assessment Observations (5 of 5)

Efforts to Address **Agency** Long-Term Research Needs (cont'd)

- Applaud effort to develop Agency Long-term (5-7 year) Code Investment Plan
  - Includes maintenance, modernization, and consolidation of agency tools and ensuring that staff has access to high performance computing capabilities
  - Work prioritized based on need for tool and impact if work delayed
- Substantial and sustained RES efforts required to address emerging technologies and code maintenance needs; implementation may require additional resources
- Planned CY 2022-2023 briefings will allow ACRS to monitor RES efforts addressing agency long-term research needs

Conclusions and Recommendations

- Current RES activities meet agency near-term needs for regulatory decisions-making and for anticipated near-term submittals.
- We continue to support the systematic approach implemented by RES to prioritize research emphasizing "enterprise risk" in project selection, evaluation, and termination.
  - International and domestic collaborations required to leverage limited agency resources
  - Additional measures, such as fixed end dates on user needs, may be needed to redirect resources when projects achieve original goals

Conclusions and Recommendations (continued)

- New RES-initiated efforts address longer-term agency research needs
  - The FFR projects are improving agency knowledge on key topics; progress should be published in annual reports.
  - RES developing strategy to prepare for reviewing fleet modernization technologies.
  - The integrated code maintenance and development plan should provide an important means to ensure that agency tools are available
  - Substantial sustained RES efforts required to address emerging technologies and code maintenance needs; implementation may require additional resources
  - Additional agency resources may be required

Conclusions and Recommendations (continued)

- Our review identified several risk-significant RES activities for which additional briefings are planned. Topics include:
  - FFR project progress
  - Progress on addressing Halden gap
  - Long-term strategy for code maintenance, consolidation, and development
  - Data science /AI strategy
  - Integrated University Projects (IUPs)
  - SiD/PHA approach for non-LWRs
- In addition, we will continue episodic reviews on activities, such as:
  - Level 3 PRA
  - HEAF
  - ATF
  - Non-LWR IAP codes
  - Reg Guide 1.247 (non-LWR PRA standard)
  - IDHEAS?
- We will continue to provide letter reports as needed.