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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

641ST MEETING

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THURSDAY,

MARCH 9, 2017

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ROCKVILLE, MARYLAND

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

COMMITTEE MEMBERS:

DENNIS C. BLEY, Chairman

MICHAEL L. CORRADINI, Vice Chairman

PETER C. RICCARDELLA, Member-at-Large

RONALD G. BALLINGER, Member

CHARLES H. BROWN, JR., Member

MARGARET CHU, Member

WALTER L. KIRCHNER, Member

JOSE A. MARCH-LEUBA, Member

DANA A. POWERS, Member

HAROLD B. RAY, Member

JOY L. REMPE, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

MATTHEW W. SUNSERI, Member

DESIGNATED FEDERAL OFFICIAL:

MICHAEL R. SNODDERLY

ALSO PRESENT:

AMIR AFZALI, Southern Nuclear

STEVE BAJOREK, NRO

TERRY BROCK, RES

AMY CUBBAGE, NRO

TINA GHOSH, RES

PETER HASTINGS, NIA

DAN HUDSON, RES*

DEBBIE JACKSON, NRO

KERRI KAVANAGH, NRO

MEENA KHANNA, NRR

LOUISE LUND, NRR

JAN MAZZA, NRO

PAMELA NOTO, NRR

WILLIAM RECKLEY, NRO

AARON SANDERS, NRR

JEFF SCHMIDT, NRO

FRED SCHOFER, NRR

MICHAEL TSCHILTZ, NEI

* Present via telephone

T-A-B-L-E O-F C-O-N-T-E-N-T-S

P R O C E E D I N G S

8:30 a.m.

CHAIRMAN BLEY: The meeting will now come to order. This is the first day of the 641st meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the Committee will consider the following:

Proposed updates to the NRC Guidance for Cost-Benefit Analysis and the Advanced Reactor Design Implementation Action Plans and Design Criteria and finally, preparation of ACRS reports.

The ACRS was established by statute and is governed by the Federal Advisory Committee Act, FACA. As such, this meeting is being conducted in accordance with the provisions of FACA.

That means the Committee can only speak through its published letter reports and hold meetings to gather information to support our deliberations. Interested parties who wish to provide comments can contact our offices requested time after the Federal Register Notice describing the meeting is published.

That said, we also set aside 10 minutes for spur of the moment comments from members of the public attending or listening to our meetings. Written comments are also welcome.

Mr. Mike Snodderly is the Designated Federal Official for the initial portion of this meeting.

The ACRS section of U.S. NRC public website provides our charter bylaws, letter reports and full transcripts of all our meetings, including slides presented at the meetings.

We have no written comments or requests to make oral statements from members of the public regarding today's session.

There is a telephone bridge line. To preclude interruption to the meeting, the phone will be placed in a listen-in mode during the presentations and Committee discussion.

A transcript of portions of the meeting is being kept and it is requested that speakers use one of the microphones, identify themselves and speak with sufficient clarity and volume, so that they can be readily heard.

I also want to make you aware that this meeting is being webcast with the ability to view our presentation slides on the web. Those of you on the bridge line may want to do that and to do so, dial onto the bridge line -- that's wrong, or connect through the NRC's public meeting website and click on

the link. It does work. The audio is usually better on the website than on the bridge line. If you have trouble, call our office.

At this time, I will turn the meeting over to Member Harold Ray to discuss the -- lead the discussion on NRC Guidance for Cost-Benefit Analysis. Harold?

MEMBER RAY: Thank you, Mr. Chairman. Last October we decided at PNP to review draft changes to Regulatory Analysis Guidance in NUREG/BR-0058 prior to issuance for public comment of those draft changes. A half day Regulatory Policies and Practice Subcommittee meeting was then scheduled for February 7th. The Subcommittee met as scheduled and staff presented and the Subcommittee discussed these changes.

In addition, staff also presented Revision 1 to NUREG-1530, which describes the determination of the NRC's Dollar Per Person-Rem Conversion Factor.

The ACRS had declined to review this NUREG in both 2015 and '16 as it was going through the process of obtaining and resolving public comments and now it is at the Commission for Final Approval.

Nevertheless, staff indicated that they sought ACRS endorsement of NUREG-1350 Revision 1 and,

therefore, given that it is presently at the Commission for approval, we will place the higher priority at this meeting on NUREG-1350.

With regard to BR-0058, staff will present today in their Slide 19 a few changes they have made in the wake of the discussion at the February 7th Subcommittee meeting.

The updated draft revision will be provided to Members following today's meeting and we will discuss whether we wish to comment on it at the April Full Committee meeting.

Meanwhile, following discussion yesterday at PNP Subcommittee, I have indicated to staff that they should proceed to seek public comments and consider any comments we may have in parallel with public comments.

Currently, we have a Subcommittee meeting scheduled in June to again discuss NUREG/BR-0058 following staff review of comments received.

In summary, as shown on the agenda for today, we will first review NUREG-1530 with the objective to decide at this Full Committee meeting if we wish to make any comments on that document.

And then we will review NUREG/BR-0058 with the objective to decide at the April Full Committee

meeting if we wish to make any comments on that document.

With that, I'll turn it over to our staff management and Pamela, Tina, whoever would like to pick up the ball. That's the way we have laid out the morning.

MS. LUND: Thank you. Okay. Good morning. My name is Louise Lund and I'm the Director of the Policy and Rulemaking Division in the Office of Nuclear Reactor Regulation.

During our presentation today, we will discuss the Cost-Benefit Guidance Update and the changes we made since the February 7th ACRS Subcommittee meeting. This briefing is going to be in two parts.

First, we will focus on the proposed changes to NUREG-1530, the reassessment of NRC's Dollar Per Person-Rem.

Second, we will focus on the proposed changes to NUREG/BR-0058 Rev. 4, Regulatory Analysis Guidelines of the NRC.

As you may know, we have been working on this update for several years. In January 2014 in response to staff requirements memorandum SECY-12-0110, the staff issued a SECY paper describing the

staff's plan for updating the Cost-Benefit Guidance.

Since that time, we have met several times with this Committee to address various cost-benefit staff initiatives included in the plan that could affect Cost-Benefit Guidance. For example, the gap analysis and qualitative factors.

Currently, the final NUREG-1530, Rev. 1, as was mentioned, is with the Commission for review and approval. The draft NUREG/BR-0058, Rev. 5, is also with the Commission for a 10-day review before being made publicly available for comment.

Several Members from the NRR as well as Research, NMSS and NRO are here this morning to support this presentation, including Pam Noto, the Regulatory Analysis Team Project Manager for my staff, who will kick off the presentation, Tina Ghosh from Research, who will lead the discussion on the Proposed Changes to NUREG-1530.

Tina is supported by the Technical Expert for this topic, Terry Brock from the Office of Research, Systems Analysis Division, Aaron Sanders, a Cost Analyst from my staff along with Pam, who will lead the discussion on Proposed Changes to NUREG/BR-0058, Rev. 4, and they will be supported by Fred Schofer, who is the Regulatory Analysis Team Lead.

And I would be remiss without also pointing out Meena Khanna, who is the Branch Chief for this particular branch.

Additionally, we have Member of the working group and key NRR management in attendance to assist in addressing any questions the Committee might have.

We look forward to addressing any questions and/or comments as you might have on both documents which include the final NUREG-1530, Rev. 1, and the draft NUREG/BR-0058, Rev. 5, for public comment.

I want to thank the ACRS for its review and support to the staff in regard to the Cost-Benefit Guidance Updates.

And now, I would like to turn the presentation over to Pam Noto of my staff. And thank you.

VICE CHAIRMAN CORRADINI: Before we turn it over, I just wanted to clarify something you said that maybe was a surprise to me.

So you went back and said that in front of the Commission is the 1350 document. Then you said something about 0058 that seemed different. Can you go backwards and say if the Commission has --

MS. LUND: Meena is going to handle that, because I think that was just slightly different than what --

MEMBER RAY: If I may interrupt, in the February 7th meeting, it had not gone up for approval for issuance for public comment. It now has done so as of the 22nd of February.

VICE CHAIRMAN CORRADINI: Oh.

CHAIRMAN BLEY: And that's without -- with the missing appendices?

MEMBER RAY: Yes. In other words, I think we will get into that. I would like to keep the focus on 1530 as much as possible --

MS. LUND: Right.

MEMBER RAY: -- because of the importance of that now, but the current draft of 0058, referred to as Rev. 5, isn't a complete revision, as I would characterize it. We can describe it in different ways, but there is more to come.

I don't know whether the more to come is going to be another increment to Revision 5 or is going to be a Revision 6. We will sort that out.

MEMBER STETKAR: I'm sorry, in the draft that we had, there are several appendices that do not exist.

MEMBER RAY: I --

MEMBER STETKAR: So it's not a complete document.

MS. LUND: Right. It is a two-phase process.

MEMBER STETKAR: Okay.

MS. LUND: Okay. And that's for --

MEMBER STETKAR: So the -- what is before the Commission that we are learning now is is whether that incomplete document should be issued for public comment. Is that correct?

MEMBER RAY: No.

MS. LUND: Yes. If I may --

MEMBER RAY: No. Let the --

CHAIRMAN BLEY: Well, John --

MEMBER STETKAR: Can I get an answer from the staff?

MEMBER RAY: Yes, you may certainly.

MEMBER STETKAR: Thank you.

MEMBER RAY: But you can describe the same thing in different ways.

MEMBER STETKAR: It's incomplete because most of the appendices do not exist.

MEMBER RAY: This revision does not include appendices that are intended to be included.

I just said I don't know whether that is going to be as a further part of this same revision or as a further revision.

MEMBER STETKAR: Okay.

MEMBER RAY: But they are identified and not included. John, I wanted to go into this later, if that's possible?

MEMBER STETKAR: Well, since we brought it up, I would like to get clarification from staff management on what Revision 5 of that document is, because the document should not have several blank appendices. The document refers to those appendices, so does Revision 5 -- is Revision 5 intended to include all of the appendices?

MS. KHANNA: So if I may, I will go ahead and start off and I'll turn to the staff. My name is Meena Khanna and this is a phase -- it's a two-phase approach that we are taking. We did discuss that we were focusing on Phase 1 currently. This is what we had committed to the Commission. We sent that back.

The SECY paper indicated that we were going to be doing a two-phase approach. So what we want to do is focus on this first phase, get some public comments, get this out there and then we will be in parallel focusing on the Phase 2 approach as

well.

So we will be talking about the differences between the two phases. Basically right now, we are focusing on administrative changes. The greater policy issues are going to be done through Phase 2, but Pam will be talking about that. So it's very, very clear that we have the intent to do a two-phased approach. We want to get again the first phase out for public comment.

MEMBER STETKAR: I understand the phased approach, that's fine. I'm trying to understand whether the thing that is going to be called Revision 5 of that NUREG, once it is finally issued final, will include all of the appendices? There can be a phased approach to getting public comments on the thing that is called Revision 5.

MS. KHANNA: Right. Fred, go ahead if you want to talk about the schedule?

MEMBER RAY: That's the same comment I made about Revision 5 versus Revision 6.

MR. SCHOFER: Fred Schofer. It's our current plan to issue the document with the -- without those appendices completed and that subsequent revisions will include that new material.

MEMBER STETKAR: Well, that's something

that I certainly didn't understand in the Subcommittee meeting, because -- and Harold, if you want, we can raise this once we get to BR-0058, but there is an Appendix H that we were told that would give analysts an awful lot of guidance on how to develop this -- the risk information to support these decisions.

And that, in my mind, is an integral part of this process. And if that appendix is not going to be issued, I don't understand what we are doing. So--

CHAIRMAN BLEY: Well, let's bring that up when we get to BR-0058.

MEMBER RAY: Thank you for that, that's what I would like to do. I mean, I think it's an unusual process from several standpoints that we are going to ask to engage in. And there is also an implication of what you have been discussing for what we are going to first discuss here, which is 1530. And that's why I -- in the dialogue that you and I have had, I suggested a couple of alternatives for how we can treat 1530.

But to some extent, we are dealing with semantics as to whether it is incomplete or it is being issued without something that is going to be added in a subsequent revision.

And we will have -- I think we will have

enough time today, we can explore that very fully, but I would like to focus now, if we may, on 1350 with the idea in mind that we have got to come to come closure about what comment we want to make on it. But I accept, John, your point, I think, which is that there are implications for 1530 and 0058 in its status, I understand that and that's correct.

We will need to decide how to express that in what we say about 1530. Okay. With that, Louise, do you have anything more you want to direct the next microphone?

MS. LUND: No, I have nothing further, at this time.

MEMBER RAY: Okay. Who is up?

MS. NOTO: I'm up.

MEMBER RAY: Pam. All right.

MS. NOTO: Thank you. And good morning, everyone. So today we are going to discuss the proposed changes made to NUREG 1530 as well as NUREG/BR-0058. And again, I'll just highlight that NUREG 1530, Revision 1, is with the Commission for review and approval and NUREG/BR-0058, Revision 5, is also with the Commission for a 10-day review. I believe it went to the Commission on March 1st. And the goal is for the document to be made publicly

available in April of 2017.

So I'll begin by just giving you some basic background information as a reminder of how we have gotten here today before I turn it over to Tina for the discussion of 1530.

So the Fukushima accident initiated questions how the NRC considers potential economic consequences of a nuclear accident within our regulatory framework. In response to these questions in August 2012, the staff submitted SECY-12-0110, the Consideration of Economic Consequences in the NRC's Regulatory Framework. And this addressed the policy question of to what extent, if any, should NRC's framework modify consideration of economic consequences of the unintended release of licensed nuclear materials to the environment.

In the SECY paper, the staff recommended enhancing the currency and consistency of the existing regulatory framework for updates to Cost-Benefit Analysis Guidance Documents and this also included updating NUREG-1530, which was last published in 1995.

So the Commission approved the recommendation and have direction to identify potential changes to current methodologies and tools to perform cost-benefit analyses and support of

regulatory backfit and environmental analyses.

In addition, staff also directed -- or the Commission also directed the staff to perform a regulatory gap analysis prior to developing new guidance.

So in response, the staff wrote SECY-14-0002, the plan for updating NRC's Cost-Benefit Guidance and this essentially, as the title states, provided the status and steps for updating the guidance and it identified potential changes to current methodologies and tools relating -- related to performing cost-benefit analyses.

So the plan aimed to establish consistent, effective and efficient regulatory guidance across the Agency as well as to take into account coordination with other Commission-directed tasks.

So this SECY paper recommended the two-phased approach to revise the content and structure of the Cost-Benefit Guidance Documents.

We are currently working on Phase 1 of the update. And I'll go into more detail about the two-phased approach a little bit later on this morning.

MEMBER RAY: Let me interrupt at this point. My recollection is that that SECY said that uncertainty would be dealt with in Phase 2.

MR. SCHOFER: Correct.

MS. NOTO: You're right.

MEMBER RAY: Is that not correct? Thank you, Fred.

MR. SCHOFER: Correct. And it got accelerated because we had a number of audits as well, which identified the use of uncertainty. So to address those audit findings, we accelerated that into the --

MEMBER RAY: All right. So that is no longer the case then.

MEMBER STETKAR: In particular, Rev. 5 does include Appendix C, which is all of the guidance on uncertainty analysis.

MEMBER RAY: Yes, I realize that and so I had gotten into a loop trying to figure out what had happened. You just now explained that there was something that occurred subsequently that caused uncertainty to be addressed in Phase 1, so that's on the table now.

MR. SCHOFER: Yes.

MEMBER RAY: All right. Thank you.

MS. NOTO: In addition, we have SECY-14-0143, the Regulatory Gap Analysis of NRC's Cost-Benefit Guidance and Practices, which was written in

response to the SRM-SECY-12-0110 direction to provide a gap analysis prior to developing new Cost-Benefit Guidance.

The gap analysis focused on identifying differences across NRC business lines and analyses in relation to methodologies and tools used for cost-benefit determinations. And it also identified where additional guidance was needed.

So the gap analysis results will be used as appropriate in both phases of the updates to the Cost-Benefit Guidance and currently an explanation of the differences identified the gap -- identified by the gap analysis are provided in Phase 1 of the update.

Additionally, we have SECY-14-0087, the Qualitative Consideration of Factors in the Development of Regulatory Analyses and Backfit Analyses and this was written in response to the SRM-SECY-12-0157, Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments.

And this directed the staff to seek guidance regarding the use of qualitative factors. So SECY-14-0087 proposed updating the Cost-Benefit Guidance to include a set of methods that could be

used for the qualitative consideration of factors.

The Commission approved the plans and directed the update to focus on capturing best practices and to provide a tool kit to the analysts.

So we have begun to tackle this in Phase 1 of the update and the draft tool kit can be found in Appendix A of the guidance to NUREG/BR-0058, which is titled The Qualitative Factors Assessment Tools and Aaron will be talking about that appendix a little bit later on this morning.

And then we also have the GAO Audit Report and OIG Audit Report Findings. The GAO Audit Report recommended that the NRC align its process submitting procedures with relevant Cost-Estimating and Best Practices that are identified in the GAO Cost Guide. This has also been addressed in Phase 1 and it can be found in Appendix B, Cost-Estimating and Best Practices of the Update.

And then the OIG Audit Report provided four recommendations primarily about knowledge management and training and this effort of updating the Cost-Benefit Guidance supports the knowledge management and knowledge transfer to cost analysts across the Agency.

So that's just a quick summary of the

background and I'll turn it over to Tina for discussion of NUREG-1530.

MS. GHOSH: Okay. So the title of NUREG-1530 --

MEMBER STETKAR: Tina, pull the mic closer.

MS. GHOSH: Okay. I believe the mic is on now. The title -- this is just the title of the NUREG-1530, Reassessment of NRC's Dollar Per Person-Rem Conversion Factor Policy. Next slide, please.

MEMBER STETKAR: Tina, pull the mike a little closer to you, so that -- you are kind of fading away.

CHAIRMAN BLEY: We're going to give you a reboot.

MS. GHOSH: Is this better?

MEMBER STETKAR: Oh, yes.

MS. GHOSH: Yes, okay. Great. So we just wanted to start out with the definition and this is quoted. It's quoted the official definition "This factor translates radiological dose to a monetary value and, as such, allows for direct comparison between the potential health and safety benefits and the costs of a proposed regulatory initiative."

So in short, this dollar per person-rem

factor helps us establish the dollar-value of the health impact of radiation dose. Next slide.

So the need for a dollar per person-rem value first came up in 1974 when the Commission identified this need in the context of design criteria for limiting routine effluent releases from power plants. And as part of the effort to come up with this value, as part of the rule, 10 CFR Part 50, which is called Domestic Licensing and Production of Utilization Facilities, the Appendix I to that Rule, Numerical Guides for Design Objectives and Limiting Conditions for Operation to meet the Criterion "As low as is Reasonably Achievable or ALARA."

The Commission established in 1975 $1,000 per person-rem as a conversion factor, which was meant to capture all of the offsite consequences of, you know, radiological releases for that rulemaking.

And subsequently, that same value --

MEMBER RAY: How about you call those low-exposure radiological releases in Appendix I??

MS. GHOSH: Yes, yes.

MEMBER RAY: As opposed to accident doses.

MS. GHOSH: Yes, exactly right. This is for the well-routine effluent release, basically, evaluating whether you are going to make design

changes to make them even lower. But that -- subsequently, that $1,000 value was used in other regulatory applications, but eventually it was revisited.

And in 1995, NUREG-1530 was published. And in NUREG-1530, that's where we established the $2,000 per person-rem. And in that, NUREG separated the offsite economic consequences from those factors, so that was no longer -- the offsite economic consequences were no longer considered to be part of this factor.

So then in 2009, the staff began research to update the dollar per person-rem value again, because it had been a while since 1530 was published. And as Pam already mentioned, when we sent up SECY-12-0110 to the Commission, we indicated that we would update the guidance documents, including NUREG-1530 and the Commission approved this recommendation in 2013.

And just for some additional background, since we know -- we knew that we were going to be updating this value, in some of our recent regulatory analyses, we have been using higher dollar per person-rem values for sensitivity analyses. And just an example of that was in response to COMSECY-13-0030, we

used a higher value of $4,000 per person-rem as a sensitivity and that was on the expedited spent fuel pool transfer. Okay. Next slide.

VICE CHAIRMAN CORRADINI: And the value was what? What was used then?

MS. GHOSH: $4,000.

VICE CHAIRMAN CORRADINI: Okay.

MEMBER RICCARDELLA: Excuse me.

MS. GHOSH: Yes.

MEMBER RICCARDELLA: For a non-expert in this area, could you, please, explain what you mean by separated the offsite economic consequences from the site?

MS. GHOSH: Yes, sure. So today, typically before reactor accidents or really any kind of accidents where you have a radiological release, we use the MACCS Code to quantify the offsite consequences from the radiological release. And through that code now, we have the capability to both project the dose to people, so a population dose in terms of person-rem, as well as separately the offsite economic consequences in terms of property damage, you know, if you lose farmland, other kinds of economic damages that isn't just the health effect of people getting a dose.

MEMBER RICCARDELLA: So kind of like what is going on in the Fukushima Evacuation Zone now, those types of effects?

MS. GHOSH: Yes, exactly. So back in '74 when they originally established the -- well, in this particular rule for the effluence, when they looked at the $1,000, they meant for that to capture all offsite economic consequences. So both people's health effects as well as other offsite economic consequences.

But in 1995, we separated out the offsite economic from just the purely health effects from the radiological.

MEMBER REMBE: But there is some limitations of what they consider for the economic effects. It doesn't capture all of the effects of the economic consequences that have occurred. For example, at Dai-ichi, like replacement towers are not covered, right?

MS. GHOSH: It is.

MEMBER REMBE: Shutdown from other plants? There is limitations. Relocation. It doesn't capture everything, right?

MEMBER RICCARDELLA: But from what I heard, we are not considering those effects anyway.

MR. SCHOFER: Well, that's not exactly correct.

MS. GHOSH: Okay.

MR. SCHOFER: Replacement tower is addressed. Now, there may be some assumptions which are different than what you are thinking --

MEMBER REMBE: Yes, because it captured--

MR. SCHOFER: -- with regard to the Japanese shutdown of their nuclear reactors. Typically, we don't make that assumption.

MEMBER REMBE: Yes.

MR. SCHOFER: But we do account for replacement tower for the site and --

MEMBER REMBE: That particular one.

MR. SCHOFER: -- the reactors on that site.

MEMBER REMBE: Okay.

MEMBER RICCARDELLA: But as I understand it, that's moot with regard to this conversation we're having --

MR. SCHOFER: That's external to what we are talking about.

MEMBER RICCARDELLA: -- today, right? Thank you.

VICE CHAIRMAN CORRADINI: And just to

further, if my memory is -- for economic consequences, SECY and the associated SRM Commission vote, that still is not part of any decision making. That is calculated, but not considered directly in the decision making process. And I want to clarify that.

MS. GHOSH: I didn't catch the question.

VICE CHAIRMAN CORRADINI: I'm sure somebody knows it better than what I just said it, so maybe Fred can help me.

MR. SCHOFER: Yes. Fred Schofer again. What that SRM said was that offsite consequences doesn't have the same standing as radiological health effects. Correct. And what they were referring to is how we do backfitting, because when we perform backfitting, offsite consequences aren't part of the equation.

MEMBER STETKAR: Offsite economic consequences?

MR. SCHOFER: Offsite economic consequences.

MEMBER STETKAR: Be careful for the record.

MR. SCHOFER: All right. Are not part of the equation. It's provided for information, but when we are looking at whether the regulatory change is

justified for the cost, when we are looking at that equation, it's radiological health effects that we are looking at.

MEMBER REMBE: So while we are digressing a little bit, reminding us, okay, you do relocation costs, but do you consider how many years of paying for people to live away from the site? Is it 30 years, 10 years? How long do you --

MS. GHOSH: Yes, I mean, right. And that goes into the input choices --

MEMBER REMBE: Okay.

MS. GHOSH: -- that the analyst makes and you can decide to put in different numbers for that.

MEMBER REMBE: Yes.

MS. GHOSH: And so certainly you could debate what is the appropriate, you know, inputs to put in, but those are inputs to be included. And that level of detail is not described in our guidance documents.

MEMBER REMBE: Okay. Thanks.

MS. GHOSH: Okay. I think we are done with this slide. So how is the dollar per person-rem factor calculated? The NRC uses an approach which is pretty common with other federal agencies as well. We multiply a current value of a statistical life by a

cancer risk coefficient.

So in NUREG-1530, in 1995, what was used was a value of statistical life or VSL of $3 million and the cancer risk coefficient established in ICTRP Publication 60 of 7.0×10^{-4} per person-rem. And this came out to approximately $2,000 per person-rem. It's actually $2,100, but it was rounded to the nearest thousand dollar at the time.

And currently, the NUREG-1530 from 1995 doesn't provide a method for adjusting this value into real dollars. So in other words, $2,000 back in 1995 was worth something different than what $2,000 is worth today. But there was no method established in that NUREG for keeping that value current considering current economic factors. So next page, next slide.

So this is just a list of the proposed changes in this proposed Revision 1 to NUREG-1530. And I'll be talking about the -- each of these in the subsequent slides and this is just a list of the things that we will cover.

So I guess the punchline, the recommendation is to update the $2,000 per person-rem factor to $5,200 per person-rem for the best estimate. And this is based on an updated value of statistical life of $9 million in 2014 dollars and an EPA cancer

mortality-risk coefficient of 5.8×10^{-4} per person-rem. And we will discuss that a little bit later.

And in this revision, we are also suggesting that it should be typical to also do a sensitivity analysis where you vary the person-rem conversion factor by plus or minus 50 percent, which would result in a low and high value of $2,600 and $7,800 per person-rem respectively.

And we are proposing to report the dollar per person-rem factor to two significant figures and we will go into why on a subsequent slide. And here we are also proposing methods for maintaining the dollar per person-rem conversion factor. So we are not in a situation of where we are today where is it 20 years later and we are still stuck with this value from decades ago. And in this provision --

MEMBER RAY: Well, excuse me. You say we are stuck with that value, but it's actually $2,000. It's expressed in dollars previously, so one can change it to current dollars if you wish, not as part of what is in the NUREG, but as part of whatever calculation you are doing.

Yes, Fred?

MR. SCHOFER: The reassessment that was done in 1995 indicates that it should be in constant

dollars and that inflation shouldn't be -- affect that number.

MEMBER RAY: Right. So I'm just saying the cost of whatever you are doing today, you can take it back to those same dollars, so you can compare the same --

MR. SCHOFER: But and one of the changes we are making is we are saying that it shouldn't be a constant dollar value. And we are changing it to --

MEMBER RAY: All right. Nothing prevents you from doing that. The comment I made is superfluous. You can put it in the Reg Guide or you can do it as part of the calculation, as long as you recognize what year the dollars are expressed in.

MR. SCHOFER: Correct.

MEMBER RAY: All right.

MS. GHOSH: And then the last bullet, we have added some guidance to the staff in this proposed revision of when to use -- to look out for when to use the dose and dose-rate effectiveness factors, really on when to remove it from the calculation. And I'll talk about that later.

MEMBER RAY: You'll talk about it later?

MS. GHOSH: Yes.

MEMBER RAY: Okay.

MS. GHOSH: We have a slide on that. Okay. So first, the value of a statistical life. This is a concept that is widely used in the Federal Government to monetize the health benefits of a safety regulation. We like to stress that it is not meant to be interpreted as the value that is placed on a human life, but rather, it is the value that society would be willing to pay for reducing health-risk.

NRC utilizes the willingness to pay method for calculating the VSL and this is consistent with other federal agencies.

And the other thing I want to point out just as an example of what does it mean in terms of willingness to pay for reducing the health-risk. If the annual risk of death were reduced by one in a million for each of 2 million people, that is considered to be to statistical life. So really the VSL is meant to be a monetization of the risk reduction across the population that is affected.

There are a lot of other federal agencies that do research in this area and they have calculated the VSL with the willingness to pay method and we are basically leveraging the research that other federal agencies have already done. And by now, we are proposing to apply a best estimate VSL of $9 million

in 2014 dollars and this is estimated from taking an average of the Department of Transportation's VSL of $9.3 million and the Environmental Protection Agency's VSL of $8.7 million again in 2014 dollars.

VICE CHAIRMAN CORRADINI: So just more background for me.

MS. GHOSH: Yes.

VICE CHAIRMAN CORRADINI: So there is no harmonization required by the Federal Government, so there is a wider range than the DOT's and the EPA's, you just happened to use those as benchmarks as to what you chose to use and it doesn't need to be harmonized?

MR. SCHOFER: Fred Schofer. That is correct. The OMB Guidance that addresses this at Circular A-4 and they have a range of $1 to $10 million for that value of a statistical life.

VICE CHAIRMAN CORRADINI: Who uses $1?

MR. SCHOFER: No one.

MEMBER STETKAR: It's interesting if you look at the -- the NUREG actually has a really good discussion of all of this stuff in it. And if you look at the ranges, DOT uses $5 to $13 as their rems, low to high. Homeland Security uses $7 to about $11. OMB uses $1 to $13, $1.3 to $13.3 miraculously a

factor of 10. They didn't think about it at all. And EPA just apparently violently will endorse only a single number, right? They don't provide -- EPA doesn't provide a range.

MR. SCHOFER: Yes, EPA -- both EPA and DOT are using point estimates.

MEMBER STETKAR: Yes, but DOT at least provides a range.

MR. SCHOFER: That's true.

MEMBER STETKAR: EPA I couldn't find a range anywhere. So the ranges even are all over the point, are all over the place. The central tendency in terms of a mean value doesn't vary all that much. It tends to be kind of in that --

MR. SCHOFER: $7 to $9.

MEMBER STETKAR: -- $7 to $9-ish sort of range.

MR. SCHOFER: Yes, yes, yes.

MEMBER BALLINGER: As a calibration point, as I mentioned during the Subcommittee meeting, the value, VSL in Russia is $71,500.

MEMBER RICCARDELLA: Did I hear you say and the 1995 value was $2 million?

MS. GHOSH: It was $3 million.

MEMBER RICCARDELLA: $3 million?

MS. GHOSH: Yes.

MEMBER RICCARDELLA: Thank you.

MS. GHOSH: And then multiply that by the cancer risk coefficient and you get the $2,000 per person-rem. It's actually $2,100, but rounded to $2,000.

Yes, the discussion leads us right into the next slide. So what is the basis? So in our -- in the Revision 1 now, we are proposing that, you know, staff should be doing a sensitivity analysis and we just wanted to add a slide. There was some discussion about the Subcommittee meeting. What is the basis for the sensitivity analysis?

And the NRC has adopted the EPA practice to use a central VSL estimate without a probability distribution and this was really based on their Science Advisory Board Environmental Economics Advisory Committee, the SAB-EEAC. And they advised using a single peer-reviewed estimate consistently. They thought that was the way to go.

The DOT guidance describes the sensitivity analysis of the facts of using alternate VSL values instead of treating alternate values in terms of a probability distribution and that, you know, the analyst should apply a test of the low and high

values. So that's the way we are going, at this point.

MEMBER STETKAR: Okay. Tina, this is your last slide, so now I get a chance to --

MS. GHOSH: It's not my last slide.

MEMBER STETKAR: -- well, but now you get a -- after that you get a cancer risk coefficiency.

MS. GHOSH: Okay, yes.

MEMBER STETKAR: So I want to probe this a little bit.

MS. GHOSH: Sure.

MEMBER STETKAR: I mentioned earlier the ranges that I could derive from the discussion in the NUREG and I didn't do enough homework to try to go back for all of the reference material to understand the rationale in each of those other agencies, but I know how this Agency uses these values in terms of supporting decision making and, in particular, risk-informed decision making, because that's, essentially, what this Agency is supposed to be doing.

Commission policy says that we should use risk information to the greatest extent possible and account for uncertainties in that information. In fact, the guidance in NUREG/BR-0058 is replete of that -- with that mantra, if you will. And in fact, BR-

0058 provides in Appendix C a lot of, in my opinion, really good information about how to think about uncertainties and the importance of quantifying uncertainty and so forth.

So my question is why, for this particular parameter, the value of a statistical life, we will get into the other parameters later, but why have we decided to only use sensitivity values? And in particular, sensitivity values that grossly under-estimate the overall uncertainty if I were to propagate those bounds through a quantitative uncertainty analysis?

So this has to be -- this is not a mathematical -- I don't want to get into the math of the type of distribution and things like that, but I can show you how the sensitivities, the plus -- the nominal plus or minus 50 percent seem to grossly under-estimate the values that we present to a decision maker who will eventually use this to make a regulatory decision.

Why has this Agency decided to do that? Other than the fact that apparently everybody else does it, so that's okay.

Part of that question is how do the other people use that information as part of their

regulatory decisions? Do they have that same type of risk-informed process that emphasizes the quantitative representation of uncertainty or is this Agency different in that sense?

MR. SCHOFER: Okay.

MEMBER STETKAR: I'm asking you because I don't know the other agencies and you guys --

MS. GHOSH: Yes.

MEMBER STETKAR: -- no, you folks, obviously, did a lot of homework when you dredged up the information that's in the NUREG. So I'm trying to get educated here.

MR. SCHOFER: Okay. I think the major point has to do with because we are leveraging the work done by other agencies and they are recommending a point estimate with sensitivities that because we are leveraging their work and they, after an extensive review, came up with that recommendation, we adopted that, so first and foremost.

With regard to how EPA and DOT performs their analyses, you know, certainly DOT is using uncertainties in developing the likelihood of, you know, accidents, whether it is airplanes, you know, truck, car, whatever. And so, you know, from that regard, I don't see that the methodologies that we use

in DOT with regard to uncertainties differ to a great degree.

However, when they are quantifying the benefit or the averted costs associated with their regulatory action, they are using, you know, that VSL number as a point estimate.

VICE CHAIRMAN CORRADINI: So can I probe that a bit? So let's say it's not $2,678 by some mathematics, which John has already done.

MR. SCHOFER: Yes.

VICE CHAIRMAN CORRADINI: It's 3 x 52 and it's 3 x less than 52.

MR. SCHOFER: Okay.

VICE CHAIRMAN CORRADINI: How does that help decision making?

MR. SCHOFER: Well, the way it does help is let's say that we perform the analysis, we do that sensitivity and we find that something goes from not being cost beneficial to being cost beneficial. Now, you have to do additional work to evaluate, okay, you have that dilemma. How do you resolve that? And it's because of the sensitivity of this particular policy guide.

VICE CHAIRMAN CORRADINI: Okay. But then the -- so let's say there is an action. Let's take

CPRR since that happens to be a more recent one. Then I would have to sharpen my pencil and know the cost a whole lot more, so it's not just the uncertainty in this. It's the uncertainty in the cost that then would be the fix.

MR. SCHOFER: Exactly.

VICE CHAIRMAN CORRADINI: So the uncertainty about. So is it the staff's opinion this sensitivity helps enough with decision making? I mean, that's what I thought you were going to tell John, which is, yes, I don't know that much, but plus or minus 50 is about good enough to create a grey area for decision making versus a plus or minus that gives me a factor, an order of magnitude.

MR. SCHOFER: Yes.

VICE CHAIRMAN CORRADINI: Because if I start doing that, then I have to do uncertainty on cost and I would think the uncertainty on cost is probably as big as the uncertainty on dose conversion, whatever would be -- not the VSL, the other thing we get to discuss.

MR. SCHOFER: And we are doing uncertainty on cost, at that point.

MEMBER STETKAR: The -- my whole point on all of this is, I come back to my own personal

experience. Had my financial advisors back in the year 2006/2007 explain to me that there might be a 5 percent probability that I would lose 40 percent of my net worth, my decision making might have been different, rather than simply saying our best estimate is that there might be a slight correction, but not a lot.

And that's my whole point about presenting the full range of uncertainty to the decision maker, because some places if the, in this case, uncertainty distributions are not regular, normal, whatever you want to call them, understanding what might be happening out there in those tails, whether it is a low bound tail or a high bound tail can be important to a decision maker, depending on how risk averse they are and what other criteria they use for their decisions.

As Fred said, if there is a 17 percent probability that we are going to exceed some value, the decision maker ought to know that, rather than simply a range that doesn't show that we will exceed that value, because the range is too narrow.

Now, if DOT does their calculations using their so-called high and low values, that's fine. If those indeed are the minimum and maximum values.

MEMBER RAY: John, can I interrupt?

MEMBER STETKAR: I know that we are doing that.

MEMBER RAY: At this point though, DOT doesn't have a backfit rule.

MR. SCHOFER: That's correct.

MEMBER RAY: And so my question in making that observation, the implied question is if what we are doing is rationalized based on the work that they have done and we haven't done, so we are adopting the benefits of them having done this work that is referenced, the group of wise people gathering, is that applicable to us given that, as you yourself said and John has elaborated, ultimately we use this to decide among other things, but we decide about backfit.

It seems like -- my first reaction is well, I don't know how applicable their methodology is since they don't engage in the kind of exercise that we do and that we just now have been talking about. That doesn't answer the question other than to say well, perhaps we need to look at this from the standpoint of how we use it and not simply say and maybe I'm being unfair here, but simply say that well, these other folks have -- do this with a great deal of

consideration.

We have looked at it and feel like it is reasonable for us to adopt their sensitivity methodology as opposed to an uncertainty methodology. Is that a fair way to describe it, John?

MEMBER STETKAR: Well, I think --

MEMBER RAY: The sensitivity versus uncertainty?

MEMBER STETKAR: -- it is, but I think that most people -- if I tell you I have done a sensitivity analysis and I have given you my best estimate and I have done a sensitivity analysis with a low value and a high value, is it your impression that those low and high values are near the ends of the range or is it just simply saying well, I did a calculation that has some sort of nominal plus or minus 50 percent?

MEMBER MARCH-LEUBA: If I could give my point of view on this, because it has --

MEMBER RAY: Well, let me answer his question. Honestly, going back to when I really did this, John, we didn't have uncertainty as a way of doing this. So I'm accustomed to a sensitivity without trying to imagine how much of the probability is captured by that range.

Now, of course, it's a different circumstance and that's why I say well, I'm not really able to decide which is the best way to go personally, because I don't have enough experience.

MEMBER STETKAR: That's -- see, that's the problem that I have always had with sensitivity versus uncertainty analysis. If indeed we express our uncertainty quantitatively with some justification for that range of uncertainty and indeed some sort of shape in between there, because the shape can affect things, there is much less ambiguity in terms of presenting the results that way.

MEMBER RAY: Now --

MEMBER STETKAR: With sensitivity analysis, all I know is that I varied it plus or minus, in this case, 50 percent.

MEMBER RAY: Yes. And that's --

MEMBER STETKAR: But I --

MEMBER RAY: -- better than --

MEMBER STETKAR: -- could have --

MEMBER RAY: -- nothing.

MEMBER STETKAR: -- I could have varied it plus or minus 27 percent.

MEMBER RAY: Yes. No, no, it's clear. I think we all understand the point. It's just that I

contrast sensitivity to no sensitivity at all and say well, that's a better -- that's better information that if I didn't have a sensitivity expression. You take it the next step. Now, I'm sorry, Jose, I'll be quiet.

MEMBER MARCH-LEUBA: True.

MEMBER STETKAR: Just one last comment. The rest of the guidance, NUREG/BR-0058, because the only reason that we are publishing NUREG-1530 is as input to the rest of the analytical process, that other guidance says we ought to be quantifying uncertainty in all elements.

And in fact, we spent a lot of effort and a lot of time and if Appendix H is ever published, guidance to analysts looking at risk quantifying uncertainty through these risk models. Appendix C tells us all kinds of different distributions and how we can use them. We spend an awful lot of effort in that governing guidance and yet here, an important element of those final calculations, we say well, sensitivity is okay on this one.

MEMBER RAY: You have persuaded me of the dichotomy here. We are going to have to come to some closure on it, but is there anything more we need to do to highlight it? Yes, Jose?

MEMBER MARCH-LEUBA: So if the discuss is over and I can finally talk --

MEMBER RAY: It was merely trying to be clear.

MEMBER MARCH-LEUBA: Yes, yes, but I have the opinion and my opinion would help. It's a completely different opinion. VSL is 150 percent subjective measurement of what society is willing to pay. It's impossible to measure, very difficult to estimate. Attempting to apply rigorous mathematical process to VSL is useless.

Okay. However --

MEMBER STETKAR: If you were applying rigorous mathematics when you select a sensitivity state --

MEMBER MARCH-LEUBA: However, I'll acknowledge that and I will --

MEMBER STETKAR: -- but it's all mature.

MEMBER MARCH-LEUBA: -- reiterate on the transcript. However, the process that the staff is using is very valuable. It is valuable in the sense that it provides consistency in that decision making process between different applications. It's not when you have different applications come in and you have to make a decision this one, this one, this one, you

are not choosing A because you like it and rejecting B because you don't like it, you are using the same criteria for all of them and that's the value of this method.

VSL you -- I can get the focus group to agree with me that VSL is $27 million. If I talk to them enough, they will give me $27 million or if I'm cheap, they will give me $2. Okay?

MEMBER BALLINGER: In Russia, they think it's $70,000.

MEMBER MARCH-LEUBA: Right, right. So we have to keep again the eye on the ball and what the staff is trying to do, whether they know it or not, is to provide consistency between different issues at the Commission level.

And when you look at it this way, you just have to provide some system that gives you an approximate solution that is not completely wrong, that can be applied in that way.

MEMBER RAY: But your begging John's point.

MEMBER MARCH-LEUBA: No, I'm not. I'm saying --

MEMBER RAY: Yes, you are.

MEMBER MARCH-LEUBA: -- that's --

MEMBER RAY: You're saying that we have a policy that says that consistent framework ought to be cast in a quantitative risk methodology. Not some arbitrary one, this particular one.

MEMBER MARCH-LEUBA: And I stipulated it's impossible to apply. A mathematical rigorous uncertainty is impossible.

MEMBER POWERS: You are already doing it as soon as you do a sensitivity analysis. It is as rigorous as anything else.

MEMBER MARCH-LEUBA: Yes, but --

MEMBER POWERS: But I'm saying that there is a policy that says don't do that.

MEMBER MARCH-LEUBA: I'm not going to filibuster.

MEMBER RAY: Well, we did -- I did ask for more time this morning than we would have normally devoted to this, because this discussion needs to take place. And so I'm not going to cut it off at this point.

MEMBER STETKAR: Part of my -- in answer to Jose, the staff -- I'm not arguing with kind of the central tendency, because I think that the staff has done a lot of homework. You have done a lot of research. You have gone out and looked at other

agencies in the United States of America. I care less about what Russia does, because we are dealing with the U.S.

And indeed, regardless of how those other agencies may have divined, an intentional word, their estimates, there tends to be general consistency in those simple estimates. A little bit of variability, 7 to 9 or something like that, and that's fine.

Aside from the OMB low value, which to me seems to say somebody picked a value and said well, let's put a factor of 10, which is not the way we have learned to do uncertainty analysis, at least in this Agency. The other ranges are also reasonable, at least the two that I can look at 5 or 6 to about 10 to 13 or so.

So we do have evidence of what other federal agencies in the United States in the 2010 to 2017 time frame understand for their purposes what they will use as a value of a statistical life and an approximate range of that value.

Now, what they have not done is specified -- they just specify a high and low value. I have not gone back and done my own homework to see whether any of them say well, this is a normal distribution or a uniform distribution or any other kind of probability

distribution. I just see high/low values and kind of best estimate.

But it's not as if we are going out and polling -- trying to go out and poll a bunch of different people arbitrarily to come up with these estimates. We have this information available to us.

MEMBER RAY: Okay. So --

MEMBER STETKAR: And we have a policy that says we ought to be quantifying uncertainty.

MEMBER RAY: Correct. I think the discussion between Jose and John has been very clear. There are others who haven't spoken up, who I know are on one side or the other of that.

But you guys are here and rather than us being debating just among ourselves, I want to get any feedback they have. Mike has a question he would like to ask.

VICE CHAIRMAN CORRADINI: So let me just-- because I know we are not on the same page as the Members on this, but let me ask the staff. So you go through this process. You do plus or minus 50 percent. You present the results to the Commission. What stops the Commission from asking well, what would happen if it was $10,000? What would happen if it was $1,000? Right? Okay. Fine.

Nothing stops the Commission for asking further penetrating questions to help them in their decision making.

MR. SCHOFER: Oh, exactly.

VICE CHAIRMAN CORRADINI: Fine.

MEMBER RAY: But you have heard now what has been said. I just don't want you to not have the opportunity to say anything more you want to say on this subject. And if there is nothing more, we will go on.

MEMBER MARCH-LEUBA: No, can we -- because I didn't present my argument for the sensitivity. If we go back to, you know, what they said before, I said that what we are trying to do is provide consistency at the Commission level between different decisions.

The sensitivity provides the -- the value of the sensitivity provides the Commission with some wiggle room because subjectively Commissioners can choose between A and B and say really B should be that. Maybe the number is not there, but it should be done.

By having the sensitivity, it's not the complete absolute -- I mean, it's not 55 miles an hour. It's between 50 and 60. Okay. So it has a value.

MEMBER RAY: Okay. So, please, if there is -- Pete, go ahead.

MEMBER RICCARDELLA: If I were on the Commission, I would like to have as a minimum some estimate of what percentile that plus or minus factor of two corresponds to.

MEMBER RAY: Well, but --

MEMBER RICCARDELLA: I mean --

MEMBER RAY: -- that would be variable, of course. So you may as well do what John is proposing, that's to say what --

MEMBER RICCARDELLA: -- is there a --

MEMBER RAY: -- 50 percent is.

MEMBER RICCARDELLA: -- practical way to establish that?

MEMBER STETKAR: Absolutely. When we get through this, I'll give you my math.

MEMBER RAY: Okay.

MEMBER STETKAR: But --

MEMBER RAY: Okay.

MEMBER STETKAR: -- that's going to be my math.

MEMBER RAY: One more time.

MEMBER POWERS: But your math is incorrect.

MEMBER RAY: I don't want you guys to just sit here and observe us talking. Charlie?

MEMBER BROWN: When you are done. No, I just want to try to -- I'm not a statistician, so I'm just trying to make sure I can wrap my hands around the difference.

MEMBER RAY: Well, if it's a discussion among us, you know, let's postpone it. I want to get their response to --

MEMBER BROWN: Okay.

MEMBER RAY: -- what they have heard us say and then move on, because --

MEMBER BROWN: Also I might forget what I wanted to ask before then, but that's okay.

MEMBER RAY: Even though we have allowed a lot of time for this this morning, because we knew it was difficult and we are struggling, do you have any other comments you want to make?

MR. SCHOFER: Well, Fred Schofer. I believe that we have, you know, pushed the bar a lot further than what we have in the past. I mean, certainly we have made a number of major improvements to, you know, maintaining and, you know, the quantification of this particular value.

But in addition, I mean, previously we

didn't even have sensitivity as part of the process. So we are pushing that forward as well.

Now granted, John would like us to go further and I know some other Members have expressed some opinions in terms of the value of having a probability distribution, but the agencies that have a lot more economists on staff are saying don't do it.

And so, I mean, at this point, we are going with their recommendation.

MEMBER RAY: All right. Thank you. Let's move on now. We do have a very hard stop later this morning and so -- and we have got quite a bit to talk about, so I think we have aired this enough.

MS. GHOSH: The next slide.

MEMBER RAY: Go ahead.

MS. GHOSH: All right. So this is the other factor in our equation, the cancer risk coefficient. The 1995 NUREG-1530 used the ICRP 60 coefficient from 1991, which is 7×10^{-4} per person-rem. And this is meant to capture not just cancer mortality risk, but also morbidity. In other words, non-fatal cancers as well as heritable effects.

In 2007, ICRP published ICRP 103 and it presented an updated cancer risk coefficient again which also can -- includes morbidity of 5.7×10^{-4} per

person-rem.

And when we initially put out our Rev. 1 for public comment of NUREG-1530, we had identified that as our new cancer risk coefficient. But we got a lot of public comments about it. There was a lot of confusion, so we kind of revisited what is the appropriate cancer risk coefficient to use.

And we ended up going with EPA's cancer mortality only risk coefficient from -- published in 2011, which has -- which was 5.8×10^{-4} per person-rem. We thought this also aligns better with quantifying -- with coupling that with the VSL quantification, so this is just the cancer mortality piece of it. And we basically have an action item in the -- a placeholder in our updated NUREG/BR-0058 to provide guidance on then how to monetize the morbidity aspect of radiological exposures.

And I just put -- we put a parenthetical that the 90 percent confidence interval that is stated in that EPA document goes from 2.8×10^{-4} to 1×10^{-3}. And our sensitivity analysis that we are proposing is meant to capture either, you know, sensitivity to either a different cancer risk coefficient or a different VSL. Yes?

MEMBER BROWN: You left out person in

front of rem in this case? 5.8×10^{-4}, is that -- you said per rem. Is that supposed to be person-rem?

MS. GHOSH: It should be per person-rem.

MEMBER BROWN: Okay.

MS. GHOSH: Yes.

MEMBER BROWN: Thank you.

VICE CHAIRMAN CORRADINI: Tina, just for clarification, you said something at the end that I didn't understand. So the sensitivity will capture this range? That's what I thought you said.

MS. GHOSH: It -- okay. So the reason we point out the numbers is that we -- in our initial draft, I think we were talking about doing the sensitivity for the VSL portion. But clearly there is uncertainty also in the cancer risk coefficient. And in the end, we just said go do a sensitivity for plus or minus 50 percent of that lump value of the dollar per person-rem, which could either be handling a sensitivity to a different VSL or to a different cancer risk mortality coefficient, because they are both uncertain.

VICE CHAIRMAN CORRADINI: Yes, yes, I understand. But the one thing I'm quibbling with is with the numbers you provide for EPA, the plus or minus 50 doesn't capture that range.

MS. GHOSH: It doesn't quite capture the 90 percent range, right. So the plus -- if you multiply 5.8 x 1.5, it doesn't quite get to -- it's like 8 point something. It doesn't -- 8.7, I think. It doesn't quite get to the 10^{-3}.

VICE CHAIRMAN CORRADINI: I just wanted to make sure I understood.

MS. GHOSH: Yes. I think that's all on that one.

Okay. So why are we proposing to go to two significant figures? I mentioned before that in NUREG-1530 it currently rounds the dollar per person-rem to one significant figure, so the 21 --

MEMBER RAY: I think you can keep this real short.

MS. GHOSH: Okay. Yes, so I think the graph explains it. Basically, two sig figs allows for more gradual change rather than a sudden lump change. Okay.

Okay. So Slide 14. We are also in this rev proposing a methodology for keeping the factor current, so we are not in this position that we publish the $5,200 best estimate and then we are stuck with it for years. And so we proposed a formula for keeping it current and propose that annually we would

update this factor using, you know, changes and inflation and real income growth when we conduct our cost-benefit analyses.

The EPA also periodically updates its cancer risk coefficients and we were saying that we would inform the Commission if the EPA adopts the new cancer mortality risk coefficient.

And in addition, you know, periodically, consistent with the practice of other federal agencies, we will periodically revisit, you know, the baseline values for the VSL. And kind of the trigger we are proposing in this rev is that if we expect that that value would change by more than $1,000 per person-rem that we would go ahead and revisit the baseline of VSL at that point.

Next slide, please. Okay. So this, the dose and dose-rate effectiveness factor. Our -- in all of our real-life data on, you know, the cancer risks from radiation doses comes basically from a high dose and high dose-rate exposures to exposed populations. In other words, for example, the atomic bomb survivors.

And in contrast, most of the situations that we are looking to monetize the potential effects of the radiological doses are at much lower dose and

dose-rates. So in that, in our dollar per person-rem conversion factor is already included a factor of the 1.5 considering that we are going to be in a low dose and low dose-rate situation.

Are you about to ask --

VICE CHAIRMAN CORRADINI: Tina, what -- from the Health Physics Society or whatever appropriate agency or professional society, what's the breakpoint that people think is high?

MS. GHOSH: It's -- yes. A dose greater than 10 rad or a dose-rate greater than 10 rad per hour. So basically, we are making an assumption that most of the time we are dealing with things much lower than this threshold, which, you know, is like, you know, routinely --

VICE CHAIRMAN CORRADINI: And that figure is 5.8?

MS. GHOSH: Yes, exactly. And then the EPA, basically, uses a factor of 1.5. So if you were expecting that you were going to be in an exposure situation that would trip those thresholds, then you should remove this 1.5 DDREF reduction and that would basically raise your dollar per person-rem by 1.5.

And I think we talked a little bit at the Subcommittee, you know, what do you envision, when

might this happen? You know, it's kind of an accident situation, maybe an occupational doses from people who are dealing with the accidents. And we wanted to put in the guidance more explicitly that staff should be looking for these situations, so that they could more appropriately monetize the effects of these higher dose and dose-rates.

So that's in there now. It's in an appendix and it's called out in the main body of the document as well.

MEMBER BROWN: Tina?

MEMBER RICCARDELLA: So this is sort of a small departure from the linear, you know, threshold really.

MEMBER BROWN: No, no.

MEMBER STETKAR: It just says if you have got a much higher dose and dose-rate, your chances of getting cancer are -- your chances of dying of cancer are kind of higher than all of the other things that are in the EPAs amalgam, if you will.

MS. GHOSH: Right, right.

MEMBER STETKAR: So you will have to account for that in your calculations.

MS. GHOSH: Yes.

MEMBER BROWN: Tina?

MS. GHOSH: Yes.

MEMBER BROWN: You made the comment when you started about the mortality due to radiation was based on, I think you used the word, much higher dose-rates. And how does that compare to this 10 rad or rem per hour, rad per hour, whichever is the appropriate? Is it --

MR. BROCK: My name is Terry Brock. I worked on this.

MEMBER BROWN: You mentioned the atomic bomb stuff.

MR. BROCK: Right, right.

MEMBER BROWN: And those are huge numbers compared to --

MR. BROCK: Well, a lot of that comes from the survivors that we are looking at probably for going on 60 years now. But the dose-rate effectiveness factor came into play and we understand that there is no observable cancers usually less than about 10 rem lifetime. That's about the cutoff for epidemiology, but we still have to regulate in that area. And there is a radiobiology theory that -- on why or why not you would have cancer at these lower doses.

So that 1.5 is really taking into account

those repair mechanisms. And so what we are pointing out here is really kind of a sweet spot in the calculation when we are doing a MACCS calculation. You are not really talking about the reentry and the low level. This little area where you are not necessarily in the acute effects range, but you are in a high enough dose to where you are actually seeing an epidemiology where we observe the facts.

So you are removing that fix, that 1.5 to account for the repair mechanisms that we have in the lower --

MEMBER BROWN: Yes, I wasn't worried about the 1.5 per se.

MR. BROCK: Yes.

MEMBER BROWN: I am just trying to get a calibration on when we -- when these mortality effects were established, she used the term much higher dose-rates.

MR. BROCK: It's --

MEMBER BROWN: And you talk about some of these lower dose-rates that the numbers you came up with -- I just wondered how the 10 compared to how were the initial mortality statistics established?

MR. BROCK: Yes, it's --

MEMBER BROWN: Are we talking 50, 100?

MR. BROCK: As far as observed effects?

MEMBER BROWN: Yes.

MR. BROCK: It's usually about 10 rem lifetime.

MEMBER BROWN: Okay. So that's --

MR. BROCK: Yes, that's really the point of departure when you see --

MEMBER BROWN: Okay.

MEMBER STETKAR: Statistically.

MR. BROCK: -- the ability to discern from background cancer risk --

MEMBER BROWN: I got it.

MR. BROCK: -- from radiogenic cancers. It's 10 rem. 10 rem we always kind of hit that mark. Below that, you start modeling.

MEMBER BROWN: And that's 10 rem per lifetime?

MR. BROCK: Per lifetime exposure.

MEMBER BROWN: Okay.

MR. BROCK: And you start modeling after that.

MEMBER BROWN: What?

MS. GHOSH: Okay.

MEMBER MARCH-LEUBA: Without counting, you may not know this answer, but without counting, the

exposure, what is the rate of cancer background? What's the background?

MR. BROCK: Just last year, it was about-- you are looking at about 23 percent of the -- if you look at all-cause mortality diagram.

MEMBER BROWN: Say again?

MR. BROCK: About 23 percent.

MEMBER BROWN: No, no.

MR. BROCK: Of all-cause mortality.

MEMBER MARCH-LEUBA: Of the total population of the United States, how many of them will die a year per cancer?

MR. BROCK: 23 percent of all deaths.

MEMBER MARCH-LEUBA: 23? Yes, but in percent. I want to go --

MR. BROCK: Oh, the actual number?

MEMBER MARCH-LEUBA: Of the 7.0×10^{-4}, I mean, how is this 7.0×10^{-4} higher than background? How much higher is?

MR. BROCK: Oh, it --

MEMBER MARCH-LEUBA: You have a 7.0 --

MR. BROCK: Okay. It's going to be 7 percent per Gray.

MEMBER BROWN: Gray, 100 rads?

MEMBER MARCH-LEUBA: No, you can --

ignoring all your --

MS. GHOSH: Are you asking -- request the total cancer totality rates versus -- are you asking what is --

MEMBER MARCH-LEUBA: Yes, what I'm asking is --

MS. GHOSH: -- the total cancer risk and the --

MEMBER MARCH-LEUBA: -- if you have -- if you remove rem from the equation of the 7.0×10^{-4}, I say even if you didn't receive any activity, any dose, what would be the probability value anyway? How much higher is 7.0×10^{-4} is from background?

MR. BROCK: Again, the background risk is about 25 percent of all deaths.

MEMBER MARCH-LEUBA: Okay. I'll stop there.

MR. BROCK: So --

VICE CHAIRMAN CORRADINI: I think I know what he is asking. He is simply asking what is the cancer mortality risk coefficient if there were no man-made --

MR. BROCK: Oh, it's -- I think you are talking about 200 per 100,000 deaths or something like that. $2e^{-3}$.

MEMBER MARCH-LEUBA: Okay.

MR. BROCK: And then if you --

VICE CHAIRMAN CORRADINI: That's what you are asking?

MS. GHOSH: Yes, and --

MR. BROCK: And then if you look -- because it's $2e^{-3}$ in safety goal space if you look at the latent cancer fatality QHO and you add the .1 percent policy decision on what is significant, it's $2e^{-6}$, so --

MEMBER BROWN: Well, there is some chart on the NRC website that talks about background dose accumulated over a year is about 300 millirem or something like that. There is a chart.

MR. BROCK: A background with medical is about 620 millirem per year.

MEMBER BROWN: Yes, take out the medical. I'm just talking about walking around, I'm getting cosmic rays.

MR. BROCK: Yes.

MEMBER BROWN: I'm getting radon, blah, blah, blah, blah.

MR. BROCK: That's about -- but you would never be able to detect any increases of that.

MEMBER RAY: Are we deviating from --

MEMBER BROWN: No, I'm just trying to understand the numbers. That's all, I'm just trying to understand the numbers here. That's all I'm doing.

MR. BROCK: The actual coefficient the EPA came up with, a lot of it is if you go back, they use a lot of the National Academy Peer 7 report models. And then that weighs heavily on the Hiroshima and Nagasaki bomb survivor data. And to go from the acute doses of a war-torn population to an American population and looking at things prospectively, you know, there are some contortions in there about transporting risks and that's pretty well-laid out in the literature and -- to get to where we are.

But that particular number we have is actually pretty consistent. You will see over, you know, the years there will be some noodling of it going up and down a bit, but usually it's between 5 to 7 percent per Gray.

MEMBER RAY: Terry, as compared to the rest of us, we've got a question from an expert here, so let's --

MR. BROCK: Sure.

MEMBER RAY: -- go with that.

MEMBER CHU: Yes, just a real quick question. I'm a little confused about this 1.5

factor. Is this something NRC has to apply or is it already in the EPA coefficient?

MS. GHOSH: It's already in the EPA coefficient.

MR. BROCK: It's in there. In a lot of the coefficients we have used over the years in radiation protection, particularly we have used a factor of 2, there is a lot of uncertainty in that value and we are trying to --

MEMBER CHU: That doesn't make sense, because in using -- when you guys use the coefficient to calculate the person-rem and all that, there is no dose relation in there. You're saying at the lower end there is a factor there.

MS. GHOSH: Right. Can I -- actually, I wanted to mention something else we didn't talk about earlier. So all of this NUREG, everything we are talking about here is meant to be for a stochastic effects from relatively low dose and low dose-rate situations. So basically, you are exposing maybe large populations to small amounts of doses.

In the NUREG we make sure to say that if we are encountering a situation where you expect acute or deterministic health effects, we don't use this. This is meant to only be for low dose and low dose-

rate situations where you haven't risen to the deterministic health effect.

But what we are trying to identify here is that there may be this gray area where you haven't reached the threshold of getting deterministic or acute dose effects, but maybe through some accidental occupational exposure, their dose-rates are actually higher than what we typically anticipate that the EPA's cancer mortality risk coefficient is quantifying.

So we are saying if you trip this, you know, 10 rad, you suddenly get 10 rad all at once or 20 rad over some -- your lifetime, I guess or some period of time, that you shouldn't just go with the mortality risk coefficient, which has this assumption that you are not in this higher dose or dose-rate area.

So we just want -- so again, we don't anticipate that we need to worry about this that often, it's probably for a very small number of cases, but we just want to be aware that in that case we expect slightly more cancer mortality rate.

MEMBER STETKAR: It's, just essentially the way I think of it, because the analyses do account for, you know, so-called occupational dose. I'll call

it first responders.

MS. GHOSH: Yes.

MEMBER STETKAR: The operators and maintenance people who are on-site and perhaps early responders to an accident and we have ample evidence of those folks, if they receive a higher dose, not a deterministically lethal dose, but a much higher dose, we ought to account for that in our cost analysis.

And in fact, the guidance in BR-0058 says you are supposed to account for those folks.

VICE CHAIRMAN CORRADINI: Higher dose or higher dose-rate?

MEMBER RAY: Either one.

MEMBER STETKAR: It's both.

MS. GHOSH: Both.

MEMBER STETKAR: It's both.

MR. BROCK: Okay. But I think I can answer his question now. I think I know what he was asking.

MEMBER RAY: All right. You will have a chance during the break to do that.

MR. BROCK: It would be about 4 --

MEMBER RAY: Are there more questions we want to discuss here relative to this NUREG on the record before we take a break?

MS. GHOSH: That's it.

MEMBER RAY: Okay. Now, I don't have the gavel, the Vice Chairman does, so he will put us into recess here.

VICE CHAIRMAN CORRADINI: Why do we need a break? I feel like we are on a -- to change our panel?

MEMBER RAY: And it's on the schedule and it's Full Committee and some people have to use the facility.

VICE CHAIRMAN CORRADINI: Oh.

MEMBER RAY: You know, there are just lots of different reasons.

VICE CHAIRMAN CORRADINI: I yield to the-- my colleague. We will take a break.

MEMBER RAY: Take your right hand over there and let's keep it -- let's get back at 10:00.

(Whereupon, the above-entitled matter went off the record at 9:48 a.m. and resumed at 10:01 a.m.)

VICE CHAIRMAN CORRADINI: Okay. Let's come back into session then. So we are going to -- per our leader of this discussion, we will go back and Harold, do you want to now pick up 0058?

MEMBER RAY: Yes. We have completed the discussion with staff about the first document that we

are talking about. And we are going to now shift to the second one.

The second one, I'll say again, is pending issuance for public comment. We will be making our comments in parallel with that issuance and it is scheduled to come back to us following receipt and processing of comments by the staff currently scheduled in June.

So at this point, we want to discuss as thoroughly as we can. We have ample time, I think, to do so with the idea in mind that we would like to give the staff our comments, if any, at the April Full Committee meeting, based on the discussion that we will now have.

And as I mentioned, they also have made some changes following the Subcommittee meeting and we will, therefore, issue you a current copy.

The last thing I'll say, I guess, is we have agreed during the break not to refer any longer to this as anything other than a complete draft, which identifies material, that will be provided at public request, that will be added in a subsequent revision at a time to be determined.

So with that, I'll turn it over then to Pam or Fred, whoever is going to take charge.

MS. NOTO: Yes. I'll take -- oh, you want to say something?

MR. SCHOFER: Yes.

VICE CHAIRMAN CORRADINI: Just hold on. We have lost our Designated Federal Official and he has just returned.

MR. SCHOFER: Okay.

MEMBER RAY: Okay.

MR. SCHOFER: Fred Schofer. With regard to what Harold indicated, I agree, you know, it is a complete document. And when you are looking at this document think of it in this way, the main body will be issued as Rev. 5. Each of the appendices are controlled individually, so they will be Reved as they are issued. So each of the appendices will be issued as Rev 0 as they are prepared and issued. That way the main document can be controlled separately from the appendices.

And with that, I'll turn it over to Pam, unless there is further discussion.

MEMBER SKILLMAN: Yes, Fred, what provision is there to ensure that the appendices don't contradict or undo an earlier portion of the document that has been frozen?

MR. SCHOFER: The idea is as the

appendices are prepared that we would be looking at the main document to make sure that if there is any conforming change required, you know, they will be made at the same time. And then should that occur, the main document would be revised and the appendix will be issued.

MEMBER SKILLMAN: Okay. Thanks.

MEMBER STETKAR: Fred, when should we -- I have looked through your slides here and I'm not sure when we should discuss things that I brought up in the Subcommittee regarding tabulations of numbers in the main body of the report that are irrelevant and outdated and yet they are in the main body of the report. And during the Subcommittee meeting, I was told that oh, yes, we realize that they are irrelevant and outdated and Appendix H is the more appropriate place to provide guidance to the analysts.

What I'm hearing now is Rev. 5 will have those tabulated values in place for use by analysts until Appendix H is eventually issued when those values might be removed from the main body of the NUREG and that brings into question about what are -- you know, what is the basis for analysts decision in the interim?

And what I'm talking about is core damage

frequencies, large release frequencies, values that are based on old studies for Zion, for example, and why are they relevant to a current plant in terms of population dose, population distribution, core damage frequency, large release frequency, all of that stuff that was dredged up with people massaging it from things that were done 25 years ago or more and now they are tabulated in the main body of the NUREG as guidance for analysts.

And during the Subcommittee meeting, I was told well, no, no, that will be in Appendix H. And yes, maybe we should take those tables out because they are not very relevant and, trust us, Appendix H will tell analysts how to do it.

Now, I'm hearing Appendix H may not see the light of day for I don't know how long.

MR. SCHOFER: Okay.

MEMBER STETKAR: That's my biggest problem with this whole approach to we aren't going to issue the appendices.

MR. SCHOFER: Okay. Fred Schofer again. Probably the best time to have a further discussion on that is where we talk about the changes since the last meeting.

MEMBER STETKAR: Okay.

MR. SCHOFER: However, with regard to, you know just as a teaser, Appendix H is currently being drafted. And so it may not be as long as you may think. We have made some changes within the document since we were last here.

MEMBER STETKAR: Okay.

MR. SCHOFER: And we will talk about that later.

MEMBER STETKAR: I'll wait then. I'm sorry. Thanks.

MR. SCHOFER: Okay. Pam?

MS. NOTO: Okay. So I'll begin with the discussion of the two-phased approach. So here we have the overall two-phased approach, which aims to resolve two separate, but important issues, structural and administrative issues, as well as policy issues.

So there are three main NUREGs that provide guidance for cost-benefit analysis:

NUREG/BR-0058, Revision 4, which is the Regulatory Analysis Guidelines.

NUREG-1409, which is Backfitting Guidelines.

And NUREG/BR-0184, the Regulatory Analysis Technical Evaluation Handbook.

Where NUREG/BR-0058 provides the high

level guidance for reg analyses and refers to NUREG/BR-0184 for the more technical information. And NUREG/BR-0058 also contains information regarding backfit.

So the first phase, which we are calling the Administrative and Methodology Enhancement Phase will resolve structural issues, terminology conformity and other administrative issues with the guidance documents.

And per SECY-14-0002, the plan for updating the cost-benefit guidance was initially to restructure the three main cost-benefit guidance documents for NUREG-1409 as well as NUREG/BR-0184 would both be incorporated into NUREG/BR-0058 as Revision 5 of the document.

Now, due to a recent tasking to the Committee to review generic requirements from the Office of the Executive Director for operations, NUREG-1409, the Backfitting Guidelines, will be kept as a stand-alone document and only cost information related to backfitting will be incorporated into NUREG/BR-0058, Revision 5.

MEMBER RAY: Okay. Now, that's one change. Another change Fred mentioned was to include uncertainty in Phase 1. He mentioned that that was in

response to something, but I have forgotten now what it was. This is --

MR. SCHOFER: Audit.

MS. NOTO: And --

MEMBER RAY: Audits? Okay. Input that the staff received from oversight of some kind.

Is that complete? In other words, is everything that we are going to say about uncertainty now part of Phase 1 and thereby part of Rev. 5 or is there more to come on that topic?

MR. SCHOFER: Right. Well, right now, Appendix C is complete and that's what we are, you know, proposing for uncertainty.

MEMBER RAY: Okay. Is there anything else that would fall in this same category of things that have been -- have had to be changed from what is described in the SECY?

MS. NOTO: Oh, we are addressing some policy issues in Phase 1. Phase 2 was setup to address the policy issues, but due to some recent Commission direction, Appendix A, Qualitative Factors, is addressing the SRM-SECY-12-0110 direction, as well as Appendix B, the Best Practices, which addresses the GAO audit.

MEMBER RAY: So several things have been

accelerated into Phase 1 from what was originally envisioned. Okay.

MS. NOTO: Okay. So now just NUREG/BR-0184 is going to be incorporated into NUREG/BR-0058. And during this phase, we are basically cleaning up guidance. We are consolidating and updating information and making it applicable across business lines. And also it is to enhance guidance and that most of the information in the main body of the document is not new information. It's all just being centralized into a single location and the document will be a consistent approach that will be used Agency-wide.

And then as we have just talked about, we have these series of appendices that will include current activities. They will address Commission direction as well as the GAO and audit report findings. And by making them appendices, this is the discussion in the beginning, it should allow for easier updates in the future, because they will be revised independently of the main body of the document.

So if we have an attribute that needs to be updated, we can work on just that attribute in that appendix instead of revising the entire document.

MEMBER RAY: This is a little pedantic, so I apologize, but should we be referring to this as Revision 5 of 0058 with Revision 0 of Appendices A, B, C, D and E or is that correct? I'm just thinking about five years from now looking back on what we are doing, is that a correct characterization?

MR. SCHOFER: It is.

MEMBER RAY: Okay.

MS. NOTO: And we're hoping that this new document structure will increase efficiency and ease the burden of updating the cost-benefit guidance.

And again then, we have this Phase 2, which will begin at the -- which we say will begin at the completion of Phase 1, but we have already started drafting some of these appendices and we are calling this the Maintenance Phase. And during this phase, we will further refine cost estimate values and begin to address and resolve any emergent policy issues that were identified by the gap analysis. And this will be more of an ongoing effort.

So the purpose of today's meeting -- so for the purpose of today's meeting, we will focus on the new material or new appendices or changes that have been made during Phase 1 of the update. And again, those include Appendix A, Qualitative Factors,

Appendix B, Cost Estimating and Best Practices, and Appendix C, the Treatment of Uncertainty.

So next slide. So here is just a list of some of the proposed changes. One of the proposed changes to the guidance, as I mentioned on a previous slide, is to expand the guidance so it is applicable across all business lines. So it is being expanded for material licensing regulatory analysis as well as NEPA analysis.

The guidance now focuses on improving methods for quantitative analysis, including the treatment of uncertainty, and developing realistic estimates of the cost of implementing proposed requirements and lastly it also provides methods for assessing factors that are difficult to quantify and it incorporates cost estimating best practices.

So here is -- next slide. So this slide represents some of the changes that we have made to the document or some of the items that we didn't necessarily make changes to, but we reviewed since the February 7th Subcommittee meeting.

So as you can see here, we added a disclaimer to three tables in the main body of the document stating that the tables will be updated and moved to Appendix H in Phase 2 of the update. We do

plan on retaining the old material, these old tables and moving them into the Historical Data Appendix, which will be Appendix G.

MEMBER STETKAR: That's what I wanted to ask, because I'm learning things here. There are three appendices, Appendix F is entitled "Data Sources"; G you just mentioned is entitled "Historical Data"; and H is entitled "Severe Accident Consequence Analysis."

What are the intent for each of those appendices? In other words, if I look at the appendix that says Data Sources, what is going to be in that appendix? Do you know?

MR. SCHOFER: Fred Schofer again. Yes, you know, this will provide additional information with regard to starting points in terms of where to go find data that may be applicable to performing your analysis. So it's not limited to, let's say, analyses performed internal to the NRC.

MEMBER STETKAR: Okay.

MR. SCHOFER: It includes, you know, where might one go to, you know, derive equipment costs or how much time does it take to install certain things or how to perform, you know, those types of activities. So it has got to provide, you know, that

type of, you know, information.

MEMBER STETKAR: Okay. Got it.

MR. SCHOFER: The Historical Data is pretty much capturing existing information that is contained currently in NUREG/BR-0058 and the NUREG-0184 Technical Handbook.

MEMBER STETKAR: Okay.

MR. SCHOFER: And so, you know, it includes, you know, the information that was done for the IPE, the IPEEEs, WASH-1400, all that type of historical stuff that may or may not be, you know, useful, but rather than have it just, you know, be retired, it provides at least, you know, some information with regard to, you know, what has occurred in the past.

MEMBER STETKAR: They may or may not be useful. I would say it's completely useless and misleading to use information from studies that were done 25 years ago for specific plants.

Now, Zion/Indian Point, you know, the 1150 plants, and infer that they are at all relevant to current analyses for currently operating plants, so that's my problem with that historical information.

Now, in Appendix H --

MR. SCHOFER: Before -- also will be

included analyses, historical analyses performed for the dual fabrication facilities as well. So all that information will reside in that appendices.

MEMBER STETKAR: In Appendix H, what's the vision for Appendix H?

MR. SCHOFER: Appendix H is the newer analyses performed in the last 10 to 15 years addressing SOARCA plus other, you know, recent NRC analyses.

MEMBER STETKAR: All right. Is it envisioned that they will also be simply tabulations of results? So I, as an uninformed analyst, can go -- just go say that the people who wrote this told me that I should go use this number out of the table or is it -- will it be guidance --

MR. SCHOFER: It will be.

MEMBER STETKAR: -- in terms of pointing people to analyses that had been done to look at methods?

MR. SCHOFER: It will be more of the latter.

MEMBER STETKAR: Okay.

MR. SCHOFER: And Tina is at the mike to discuss it.

MS. GHOSH: Okay. Well, I'll make it

quick. So as --

MEMBER STETKAR: You are?

MS. GHOSH: Oh, I'm sorry, Tina Ghosh, Office of Nuclear Regulatory Research.

I think someone mentioned earlier Appendix H is in progress, so hopefully it's not 10 years from now that you finally see it. We are working on it and the vision right now is to try to capture -- I don't know if you are familiar with the existing 0184 document, which is the more detailed handbook that staff has from 1997, but we are trying to capture both what is considered a standard analysis, which is meant to be kind of a screening approach that might help you decide whether you go further in the first place as well as the more detailed analyses that you all saw in the post-Fukushima rulemaking activities.

And so right now, the plan is to capture both and have guidance for both.

So as you mentioned, a lot of the existing tables are pretty outdated. Right now, we are trying to compile at least sources of information that are more up to date, but with help, do some type of screening analysis for that analysts as well as capturing the guidance for the more detailed analyses should you need to go that route.

MEMBER STETKAR: Okay. That helps me out. Obviously, you know, until we see the appendices, it's difficult to understand what they might hold.

My experience is analysts who are under pressure given tabulations of numbers will just go use those tabulations and rely on the wisdom of the people who put the numbers in the tables or defer the responsibility to those folks.

So I having seen people historically misuse tabulated numbers terribly, especially old, outdated tabulated numbers, I would be concerned about that.

Guidance or reference material that points people to the types of analyses that, indeed, were done to support some of the more recent post-Fukushima conclusions, I think is really, really good because that information exists within the Agency. Some of those analyses were timely, contemporary. They were, I would say fairly in my opinion, complete. You can always argue the details, obviously, but it at least gives analysts an idea of what has been done and the types of thoughts that have been included in different analyses.

So you know, if I haven't thought about the fact that this particular study that I'm looking

at looked only at a limited number of initiating events from internal events at full power operation with other constraints, I'm aware that other people have looked at fires and floods and seismic events and other modes of operation and provide people some references to say well, here is where people did that.

MR. SCHOFER: Yes.

MEMBER STETKAR: So if that's the intent of Appendix H, that sounds very, very good. If it's simply more tabulations of numbers, that's not so good.

MR. SCHOFER: No.

MEMBER STETKAR: Okay. That's good. I'm still bothered a bit by the fact that we are issuing Rev. 5 of the main body of the report with tables of numbers with warnings that say use these with caution, that they are going to change later.

MR. SCHOFER: But it's no worse than what we currently have.

MEMBER RAY: Let's debate that later. Can we -- let's move on now. I am getting a little concerned about time, so --

MS. NOTO: Okay. Another change that we made, there was concern that Section A.4.4, the Bounding Analysis section, wasn't complete, so we

beefed up that section a little bit since the last time we met.

We reviewed Table B-2, which is in Appendix B, which calls out an 80 percent confidence level as an example. And we looked back at that and verified that the information in the table is correct. It is sourced directly from the GAO Cost Estimating and Assessment Guide. It is GAO's Best Practices and, therefore, no change was made to that number.

There was a discussion that enclosure B-4 to Appendix B was incomplete and that is correct. It is. And that is to be developed in Phase 2 of the update.

And then figures, some figures in Appendix C have been revised. Figure C-2 was revised to reduce the number of sig figs on the tornado diagram. And then Figure C-3 in Appendix C was revised to show the mean value instead of this risk adjusted primary estimate.

MEMBER STETKAR: That has disappeared from the figure?

MS. NOTO: It has.

MEMBER STETKAR: Thank you. I don't need to understand what it was, but thanks.

MS. NOTO: Yes. So those are the changes

that have been made and I'll now turn it over to Aaron for a discussion of the new appendices.

MEMBER RAY: And again, we will transmit a copy of this slightly revised version of the draft.

MR. SANDERS: All right. So my name is Aaron Sanders. I'm a cost analyst on the Reg Analysis Team at NRR and I'll discuss --

MEMBER STETKAR: Aaron, just --

MR. SANDERS: All right.

MEMBER STETKAR: -- one more comment. I read my notes in real-time.

One question during the Subcommittee meeting that I did raise that is in the main body of the, I think it's in the main body of the, report, isn't it? And I can't find my notes on it right at the moment. Was this -- the issue of what guidance is used for calculating the cost associated with doses to first responders, is that in the main body or is that in one of the appendices?

It's in -- actually, it's in the main body. I just found it. It's Section 5.3.2.3. And there are two equations in there for immediate doses and long-term doses to -- it's under Occupational Health, but I'll call it first responders.

And we discussed whether or not the -- in

those equations there is a variable which is called R, which is the dollar per person-rem conversion factor. And for long-term doses, I understand why that R should be the nominal values from NUREG-1530.

For the immediate doses, it's not clear whether that R should be the escalated values, in other words, the 1.5 multiplicative values. Did you think about that? And did you make any changes to it?

MR. SCHOFER: We did think about it. We did not make any changes, at this time. The idea is that you would be using the appropriate value from NUREG-1530, so if you are calculating, you know, radiological exposures that, you know, tripped the high dose-rate, high exposure, you would use the higher value. And that has to be calculated, you know, separately.

And if it is not tripping that, then you would be using the 5200.

MEMBER STETKAR: But no -- the document itself wasn't changed to alert people to what you just said or was it? In other words --

MEMBER RAY: Let's ask it this way, John. Would it be problematic if it did what John suggested say use --

MR. SCHOFER: Oh, not at all.

MEMBER STETKAR: In other words, if nothing else, R and R footnote or something or other.

MR. SCHOFER: Yes.

MEMBER STETKAR: Because if I'm an analyst, I'm just going to charge through here using a value that you told me to use.

MEMBER RAY: Just an issue of clarity.

MEMBER STETKAR: Yes.

MEMBER RAY: Okay. Fine. So we can capture that as a comment, John.

MR. SCHOFER: We understand that.

MEMBER RAY: Just to make sure it gets done if they choose to do it.

MR. SANDERS: So the first appendix I want to talk about which we will just discuss the ones with changes or new information to present the ones that we were mentioning earlier is the Cost Estimation Appendix. In updating and revising our process, many procedures were incorporated, best practices largely from GAO, OIG and NEI.

The primary ones from GAO are shown in the four sub-bullets there. Credible essentially means we take into account limitations of the analysis due to uncertainty or biases around data and assumptions and determine the sensitivities of outcomes to the input

parameters. And finally, recommend, an independent cost estimate to see if other methods would yield different results.

By well-documented we essentially mean what it says. There is a technical baseline description. All the steps are documented. You know, every work, breakdown work we have done, structure element is clear in how it was derived.

Accurate just means not overly conservative or optimistic. You're revising estimates when things change, such as schedule and it's -- it ties into being well-documented. You can't very accuracy unless the documentation is solid.

And the comprehensive, you need to double check that all the costs are taken into account, speak to the subject matter experts, really try to flesh out all of the elements of the work breakdown structure and define them thoroughly.

And let's see --

MEMBER KIRCHNER: May I ask a question?

MR. SANDERS: Yes.

MEMBER KIRCHNER: I may have missed it at the Subcommittee meeting or maybe I asked and don't remember your answer. At what -- what is the threshold for an independent cost estimate?

MR. SANDERS: That's a good question.

MEMBER KIRCHNER: There is a requirement, this is why I was cautioning yesterday the different setting against adopting the DOE processes were critical decision points, because there are requirements are for independent cost estimates.

But here you -- since you are going to put this against all your business lines, it seems to me you are going to have big issues that involve large dollars and smaller issues. So it seems to me there would be a threshold somewhere on requiring an independent cost estimate.

MR. SCHOFER: Fred Schofer. Currently, it is at management discretion. We have not adopted the DOE method or the -- specifically, you know, assigning that threshold value of when that would occur.

MEMBER KIRCHNER: Okay.

MR. SCHOFER: But I will say a couple of things. As part of our process, you know, we are currently performing cost estimates much earlier in the process and we are doing it even before we get to rulemaking, so at the regulatory basis stage we have a pretty complete reg analysis that goes with that, which goes out for public comment.

If we are getting comments back that would

indicate that, you know, the estimate is, you know, not reliable, then certainly that would feed into that position.

MEMBER KIRCHNER: Thank you.

MR. SANDERS: So in addition to incorporating best practices, the appendix also discusses methods and procedures for preparing cost estimates for all NRC work and that includes, you know, engineering buildup, a type of activity-based costing, it's commonly understood and frequently used. The tasks at labor hours/material costs, equipment costs and subcontract costs, for example.

And parametric estimating techniques where you develop a statistical relationship between historical costs and program, physical and performance characteristics, it's known as the top-down approach. You know, using terms like weight, power, lines of code, performance characteristics such as deployment plans, IT installations, maintenance plans, evaluation schedules, you know.

And then that determines your cost drivers and then you can use that to provide statistical results on a new program.

And then it further discusses the use of analogies if one element is like another known element

or a scalar estimate if the element is similar but of a different size.

And then finally, as the last bullet says it discusses life cycle costs. When you get into that discussion in the appendix, it talks about the net present value calculations, the 3 percent and 7 percent discount rates and how to select your proper time horizon, you know, ASME Code cases of three year lifetimes or, you know, the entire average reactor, remaining reactor life or, you know, individual reactor expected remaining lifetimes and make sure that you use the appropriate time res for each analysis.

That's it for that one, yes. And the next appendix I'll discuss is the Uncertainty and Sensitivity Analysis Appendix. So in the past, the NRC tended to use point estimates and applied sensitivity analysis on a case-by-case basis. Infrequently using uncertainty analysis.

And in this case, in the revised guidance we are instructed to perform uncertainty and sensitivity analyses for each cost estimate as additional tools for decision makers.

I think we are familiar, but just briefly, sensitivity analysis shows how sensitive the outcome

is to variations in the input parameters. Typically, one input at a time, but you can also assess multiple inputs. And you can understand which elements have the most impact on the final outcome and alter your reaction in order to increase benefits or lower costs.

And uncertainty analysis assesses the range of outcomes and the relevant probabilities of different outcomes using many trial runs. We tend to use Monte Carlo Analysis for this, which is a method using trial values with the random sampling technique for input variables where there is uncertainty.

You will get a frequency distribution after many trials and you can see the range of values and then the probability that the cost will be less than or equal to that value on the graph.

In general, the appendix advises the detail and breadth of your analysis. Your uncertainty analysis should be commensurate with the overall policy significance complexity and level of controversy as well as the perceived importance of the uncertainties to the bottom line conclusion.

Typically though, in our cost estimating, we were applying uncertainty to all the parameters where we can derive a range for uncertainty analysis, so that it's comprehensive.

The software tends to make it simple to do that.

MEMBER STETKAR: Except for the dollar per person-rem. I had to say that.

MR. SANDERS: Yes, ouch. All right.

MR. SCHOFER: Well, just to be clear, there is two parameters that we do not do uncertainty on: The dollar per person-rem and the discounted rate.

MR. SANDERS: Right.

MEMBER STETKAR: Hum? Okay. But one could argue that the uncertainty in the discount rate is going to be fairly small.

MR. SANDERS: Well, it depends --

MR. SCHOFER: No.

MEMBER STETKAR: -- on your time frame. I'll recant to that.

MEMBER RAY: Is that on the record that you recant that?

MR. SANDERS: Any time frame you put on here.

MR. SCHOFER: Yes, any time frame.

MR. SANDERS: So, yes. And then the final appendix I'll discuss today is the Qualitative Factors Appendix. This appendix, as discussed before, was

driven by a lot of interaction with the Commission and is a lot of new information for analysts. It establishes a structured process. What to do when you can't seem to quantify a certain input parameter or a factor, use it as leverage, as guidance and best practices for how to evaluate those factors. It gives you a number of standard methods in the tool kit.

I'm not going to go into all, but I do have them here. I think they are on a backup slide. But I don't know if anyone is interested in actually discussing, but we had a slide of all the different ones in the tool kit.

But and then by using qualitative factors as well as quantitative factors, you can provide more transparency and consistency by discussing those elements which may be vital to a decision, but can't be quantified.

So it's important to notice that if you are analyzing a qualitative factor and it seems to be significant enough, perhaps you should pursue further research and spend more time to quantify it. It might be worth an actual analysis as opposed to just representing it qualitatively.

And again, it makes it clear in the appendix and multiple places of the document that this

is only when quantification is not feasible. You should always try to quantify as much as possible. And that's all I had.

MS. NOTO: All right. So I'll wrap it up. So again, the drafted NUREG/BR-0058 is currently with the Commission for a 10-day review. It was given to the Commission on March 1st. A 60-day public comment period will be in April. The goal is to issue the document for use by March of 2018. And at that point, Phase 2 will begin after the March 2018 issuance of the document.

CHAIRMAN BLEY: It seems no matter how long I'm around here, I hear a new concept I didn't know. Tell me, it's up for a 10-day review. Is that the standard process? What's the 10-day review mean with respect to the Commission? Is this only done for certain things or is it the normal way you send things up?

MS. NOTO: I believe it is only done for certain things. We had an SRM.

MR. SCHOFER: Yes, we have an SRM that indicated that they have 10-days to do negative consent.

CHAIRMAN BLEY: Okay. So it came from them? This was their direction. Okay. Thank you.

I didn't remember that.

MR. SCHOFER: It's typically for policy-type items so that they have the ability to weigh in before it goes out. So both on NUREG-1530 as well as this NUREG, we had that requirement.

CHAIRMAN BLEY: Okay. Now I understand that.

MS. KHANNA: If I may add to that? This is a new policy, so we just recently received an SRM from the Commission where they want early engagement and early involvement, so they have asked to be able to look at these documents and that's exactly right what Fred had mentioned.

MS. LUND: And just to add on for completeness, there are a number of products that we do this for. It's sort of a negative consent kind of thing.

CHAIRMAN BLEY: Yes.

MS. LUND: And they get 10 days and if we don't get notification back, then we are --

CHAIRMAN BLEY: You're good.

MS. LUND: -- then we did an arrow test license transfer that way just this past week.

CHAIRMAN BLEY: Okay. Thanks.

MS. NOTO: Okay. That's everything that

we have.

MEMBER RAY: Okay. Well, the, I guess, volume of work we have to do is in this area of 0058. And -- but the more urgent thing that we have to do is decide on whether we are going to say anything and what it will be concerning 1530, so that's where we are, at this point.

We do have time for anybody to explore any further questions that Members may have before we go to public comment. And therefore, I want to make sure that we ask if there is any other questions on either document, but now we are doing 0058. As I say, it's extensive and we will be working our way through it as the document is out for public comment and plan to reach a conclusion at our next Full Committee meeting in April.

We -- of course, you won't need to make a presentation at that time, but we will advise you when we discuss the letter, so that you might be available.

CHAIRMAN BLEY: Harold?

MEMBER RAY: Yes, sir?

CHAIRMAN BLEY: I did have more of a comment than a question and I apologize for missing much of the discussion this morning.

I'm not convinced that although we are

putting off writing the full letter on the cost-benefit, that we shouldn't have a line or two, if we agree on this, I don't know if we agree, that might say we think it's a bad idea to send out the Phase 1 document for review without the appendices, because of the references from inside the document that review can't really be complete if you don't have those to go on.

I'm just wondering about that.

MEMBER RAY: Well, we --

CHAIRMAN BLEY: Something short.

MEMBER RAY: Okay. And you are talking about it in the 0058 letter or in a --

CHAIRMAN BLEY: Or a separate, very, very short letter.

MEMBER RAY: Okay. By the way, the current draft of the 1.5 letter -- 135 letter.

CHAIRMAN BLEY: .5 letter, yes.

MEMBER RAY: The current draft of the 135 letter does acknowledge that this other letter was -- John, do you want to say something?

VICE CHAIRMAN CORRADINI: It's NUREG-1530.

MEMBER STETKAR: It's NUREG-1530.

MEMBER RAY: What did I say?

CHAIRMAN BLEY: 135.

MEMBER RAY: Oh.

CHAIRMAN BLEY: But we knew what you meant.

MEMBER RAY: Well, thank you for correcting me, because I tend to do that all the time and I haven't got a clue why. But in any event, 1530.

MEMBER STETKAR: It was okay when it was 1350.

CHAIRMAN BLEY: Stop please.

MEMBER RAY: The current draft of that letter does acknowledge that we also, at these same meetings, did review 0058 and that we will be addressing it separately. And so there is an opportunity if we want to say something in that one letter.

CHAIRMAN BLEY: Okay. We can do that in our --

MEMBER RAY: Yes, of course.

CHAIRMAN BLEY: -- deliberations.

MEMBER RAY: That's right.

CHAIRMAN BLEY: I just wanted to say I was a little concerned about that.

MEMBER RAY: And one thing that was discussed at some length when you were not here was how to characterize 0058 with the appendices that it

has and the ones that are not there. And the characterization would be that Revision 5 is complete and Revision 0 of the appendices that we do have are part of that package.

There are other appendices that are identified to be added subsequently as Revision 0 of those appendices. In other words, we are dealing with Revision 5 of 0058 with Revision 0 of Appendices A, B and C. And the other appendices that will be added in the future are identified, but they will be issued as revisions of those appendices when they are ready for issuance.

Now, how that will work, we didn't explore. In other words, you have just come out with Revision 0 of Appendix H or do you come out with the document now including Revision 0 of Appendix H? Do you want to comment on that? And then I know John wants to say something.

MR. SCHOFER: Yes.

MEMBER RAY: But in the alternative that I just posed, which would it be? Would you just come out with Revision 0 of Appendix H period?

MR. SCHOFER: As a minimum there would be a Table of Contents that would be issued with that revision to identify the current rev of each piece of

the document.

CHAIRMAN BLEY: Okay. Well, I did have a point of clarification I would like to raise.

MR. SCHOFER: Sure.

CHAIRMAN BLEY: But I think John was --

MEMBER STETKAR: No, no, go ahead.

CHAIRMAN BLEY: -- wanting to -- and that is at the Subcommittee meeting I had asked if we can call this a work in progress. And I think, Fred, you said yes. Was that just with regard to the appendices or to the main body of the report as well? I thought it was the main body, but it was a work in progress overall was the way you characterized it.

MR. SCHOFER: Fred Schofer again. I would say that the project is a work in progress in that we have created, you know, final deliverables as part of that process.

MEMBER RAY: Yes.

MR. SCHOFER: But we still have more to go.

CHAIRMAN BLEY: But those you considered they are complete. They are not works in progress anymore? They are finished?

MR. SCHOFER: Yes.

MEMBER RAY: Revision 5 --

CHAIRMAN BLEY: I misunderstood that.

MEMBER RAY: -- is a complete Revision 5 and the other Rev 0s are --

CHAIRMAN BLEY: I got it.

MEMBER RAY: -- complete as well.

CHAIRMAN BLEY: Yes, John?

MEMBER STETKAR: In terms of stability of guidance, so that if I'm doing an analysis I know where to look, when, and I'll pick a completely different appendix. Let's say Appendix Frank, which right now is F is blank. When that is issued, will the version of NUREG/BR-0058, would that appendix be a different revision, let's call it Revision 6, or will it still be Revision 5 with that appendix? And how do I know which Revision 5 I need to go look for as an analyst?

So I'm an analyst out there somewhere doing this stuff and I pick up Revision 5 of NUREG/BR-0058 and it doesn't have Appendix F and there is a different Revision 5 of the same NUREG that does have Appendix F in it. I'm confused now.

MR. SCHOFER: Okay.

MEMBER STETKAR: Do I have to look at dates on ML numbers? That doesn't help me sometimes when I try to do searches.

MR. SCHOFER: No. The Table of Contents will identify the revision status of each piece of the document. So if Appendix H gets issued, you would at least have a Table of Content Revision as well as that appendix.

Now, the only time that the main body would be revised with -- when an appendix is issued is if conforming changes needs to be performed on that main body.

MEMBER STETKAR: I guess I'm still confused if I'm an analyst knowing what to go look for. Do I need to search several different versions of Revision 5 in ADAMS before I find the one that has got the most up to date Table of Contents? And how do I know that's the most up to date Table of Contents?

MS. KHANNA: This is Meena and if I may chime in, I think this is a good question, because we do want to make things easily --

MEMBER STETKAR: Yes.

MS. KHANNA: -- accessible to the staff, right? And so I think if you don't mind, we would like to take this back and consider it, but I do think that maybe what we should do is issue a rev, but let's -- let me talk to the staff and we will look at pros and cons.

MEMBER STETKAR: That would --

MS. KHANNA: We want to do the most efficient.

MEMBER RAY: You can expect that our letter will note that this is something that we raised and that you are considering.

CHAIRMAN BLEY: And it's not just staff. Reg Guides are for everybody.

MEMBER STETKAR: Well, this is a NUREG.

CHAIRMAN BLEY: Oh, this is a NUREG.

MEMBER STETKAR: This is a NUREG.

CHAIRMAN BLEY: NUREGs are for everybody.

MR. SCHOFER: NUREGs are for everybody.

MEMBER STETKAR: This one is one that industry will be interested, for example, in looking at the current version of whatever the guidance is.

MEMBER RAY: As you know from the discussion earlier, I have been as confused as --

MEMBER STETKAR: Well, it's -- I find it difficult going into ADAMS often. I find it difficult, it's a little more difficult currently, but going into ADAMS, the new and improved, and finding the most recent version of something. I mean, you know, you have to look at dates, but sometimes the date it is entered into ADAMS is out of sync.

MEMBER RAY: I --

MEMBER STETKAR: So having clear --

MEMBER RAY: -- take for granted that if you changed even for conforming purposes, you would make it Rev. 6. But if you didn't change it and simply issued a different Table of Contents with an additional appendix, then that is the problem that John is describing.

MEMBER STETKAR: That's the problem, because then I don't know which --

MEMBER RAY: Yes.

MEMBER STETKAR: -- version of Rev. 5 to pull up.

MEMBER RAY: Okay. Well, I just wanted --

MS. LUND: And this is Louise Lund. We do understand the problem. I mean, Meena and I have been discussing it, so --

CHAIRMAN BLEY: I would like to just ask a question since John got into all this detail.

If you are somebody like John and you rummage through ADAMS trying to find it, it's one thing. If I go up on the public website and I go to the document collections and I look this up, will that always be the most current? I hope somebody would say yes, but I mean --

MR. SCHOFER: Yes, this --

CHAIRMAN BLEY: -- within a week or two.

MR. SCHOFER: I mean, there are other NRC documents that are controlled in this fashion and EPA controls documents in the same fashion. In fact, if you look at EPA's Regulatory Impact Assessment Guidance, you will see that they have a main document plus appendices that are controlled individually and are identified on that website.

So I envision that we will be doing something similar to that, so that John won't have to rummage through ADAMS to try to figure out and piece together the most current, but, I mean, more to come on that.

MEMBER RAY: Okay. Well, I think that is fine for now. Other -- any other questions on the stand? Seeing, not -- hearing none, I'll turn it back -- oh, excuse me. We have to do the public comment period. I almost missed that.

Are there any persons here in the room that would wish to make a comment, at this time? If so, please, come to the microphone. And while that is occurring, I'll ask that the line be opened to permit any comments over the telephone that may be made.

No one is at the microphone. So we will

ask if there are any comments from anyone who is on the phone line, trusting that it is open for that purpose.

THE OPERATOR: Bridge open.

MEMBER RAY: Thank you. Okay.

MR. HUDSON: Yes, hello. Can I be heard?

MEMBER RAY: Yes, please, go ahead and state your name, please, and provide us your comment.

MR. HUDSON: Yes, hello. I'm actually Dan Hudson and I'm a Member of the NRC technical staff in the Office of Nuclear Regulatory Research, Division of Risk Analysis. And I actually participated in the Cost-Benefit Working Group meetings that have been focusing on updating this guidance that you are talking about today.

And what I would like to comment on is briefly the issue of whether uncertainty about the value of statistical life or VSL parameters should be treated probabilistically. I know this was something that we spent some time on at length in this meeting earlier.

And I believe that a helpful reference in this respect is a book by Granger Morgan and Max Henrion titled "Uncertainty," a guide to dealing with uncertainty and quantitative risk and policy analysis.

And these individuals identify a number of different types of uncertain quantities and provide some guidance about how the uncertainty about these quantities should be treated.

And one of those types of uncertain quantities is the value parameter. And the value of statistical life is one pertinent example of the value parameter along with the discount rate and risk tolerance.

So in this book, you will see that they clearly recommend that value parameters not be treated probabilistically and instead be treated in a parametric way using sensitivity analysis to explore the impacts of using a range of alternative values to determine whether or not your value judgment has an impact on the decision at hand.

So I thought it would be worthwhile to get that on the record to perhaps explore the guidance that is provided in that document.

MEMBER RAY: Thank you very much. Anything else you would like to offer?

MR. HUDSON: That was it. Thank you.

MEMBER RAY: All right. Any other comments? Hearing none, I turn it back over to you, Mr. Chairman.

CHAIRMAN BLEY: Thank you. Much earlier, as a FACA Committee, we can't fiddle with the schedule, so we will return at 2:00 p.m. and take up Advanced Reactor Design Implementation Action Plan.

At this point, we will recess until 2:00.

MEMBER RICCARDELLA: We can't start --

CHAIRMAN BLEY: What?

MEMBER RICCARDELLA: -- on the letter?

CHAIRMAN BLEY: No.

(Whereupon, the above-entitled matter went off the record at 10:51 a.m. and resumed at 2:02 p.m.)

CHAIRMAN BLEY: We are back in session with the Full Committee meeting this afternoon. I'll turn it over to myself.

We are going to have a session on the Advanced Reactor Design Implementation Plans and Design Criteria. And at this time, who shall I turn it over to? Go ahead.

MR. SEGALA: Thank you. So I'm John Segala, the Chief of the Advanced Reactor and Policy Branch in the Office of New Reactors and I'll be very short here.

We briefed the Subcommittee on February 22nd on the Non-Light Water Reactor Design Criteria and so we had some really good discussions then. And

then yesterday we had a pretty long all day meeting yesterday on the NRC's vision and strategy for advanced reactors as well as our Implementation Action Plans.

So for today's presentation, Jan Mazza is going to go through and provide an overview of our discussions for the Non-Light Water Reactor Design Criteria and then Amy Cubbage is going to provide an overview of our vision and strategy document and our Implementation Action Plans.

So with that, I'll turn it over to Jan.

MS. MAZZA: Thank you. So hello again. I'm just going to go quickly through my overview.

As you will recall, we have a Draft Guide 1330 out for public comment, Guidance for Developing Principal Design Criteria for Non-Light Water Reactors. It went out February 3rd. It is due April 4th. Comments are due April 4th.

We had our Subcommittee meeting on February 22nd and we discovered -- discussed several of the design criteria in depth. So today, I'm going to provide a brief summary of the select group design criteria and significant comments that we made -- that the ACRS made during the Subcommittee meeting.

CHAIRMAN BLEY: Okay. Thanks. And if --

well, the Members may have. The ACRS hasn't made any comments yet with regard to the letter.

MS. MAZZA: Yes.

CHAIRMAN BLEY: Just as a reminder. My understanding is that after you get public comments and our letter, you will be coming back with a -- to us with another version of this somewhere on towards summer?

MS. MAZZA: Yes, yes.

CHAIRMAN BLEY: Is that right? Okay.

MS. MAZZA: Okay. So the first topic I want to talk about is reactor design. Specifically, the Modular High Temperature Gas Reactor Design Criteria No. 10. A summary of the adaptation from the current GDC is that specify acceptable system radionuclide release design limits or SARRDLs are used instead of the specified acceptable fuel design limits or SAFDLs.

And the SARRDL concept allows for some small increase in circulating radionuclide inventory during an anticipated operational occurrence. So comments from the Members at the Subcommittee meeting provide more information on how the definition of -- more information on the definition of SARRDL, how it would be implemented.

In addition, the staff should consider using specific acceptance criteria which correspond to TRISO fuel failure modes. The use of the specific criteria would be more consistent with the current GDC 10 SAFFDL approach. And also include monitoring of plate-out activity in addition to circulating activity.

Any comments or additions?

CHAIRMAN BLEY: I think that's fine. And I think DOE or the labs had talked about that last one, too, as being a key thing, the plate-out.

MS. MAZZA: Okay. The next one is containment design. So for the Advanced Reactor Design Criteria No. 16, the adaptation summary is that the ARDC 16 is the same as the current GDC 16 which specifies an essentially leaktight barrier.

ARDC 16 also acknowledges that other non-light water reactor designs may use the SFR or mHTGR design criteria. However, a policy decision would be needed at the -- if mHTGR-DC is used.

And for comments, we have defined for as long as postulated accident conditions require. The example was a containment floor leakage at TMI-2 with the concern well after the accident. Define containment performance requirement for containment

function, rather than leaktight or low-leakage, etcetera.

For the SFR-DC 16, SFR-DC specifies a high strength low-leakage pressure retaining structure surrounding the reactor and its primary cooling system. And here consider the possibility of common mode failure of multiple barriers and the example was a guard vessel sharing a foundation with the reactor vessel.

And then finally, mHTGR-DC 16 specifies a functional containment that does not have a pressure retaining structure. The TRISO fuel provides multiple barriers of protection and here it wants to clarify that containment performance requirements will be dependent upon licensing basis events, which need to be defined.

MEMBER BROWN: Can you go back a slide? It just occurred to me, even though I sat in on the meeting, right now we specify fuel design limits as part of the overall reactor design don't exceed some numbers.

Now, you discard that and say we are going to say it's okay to release radionuclides. Doesn't -- does that -- that implies relaxation in design margin for reactor operation and design --

MS. MAZZA: I'm going to let Jeff --

MEMBER BROWN: -- which sounds -- just seems counterintuitive.

MR. SCHMIDT: Yes, I think that is -- this is Jeff Schmidt from the staff. Yes, I think that is one way to interpret it is what you are trading is small or benign releases potentially for protection against catastrophic releases. So there is some trade-off there.

MEMBER BROWN: Okay. How do you define benign or how do you argue that you can have something or the -- how do you categorize an accident that only results in small benign releases of radionuclides as opposed to none?

MR. SCHMIDT: Well, I think you have to look at that versus, you know, the accident scenarios and the dose criteria that you use. So you wouldn't use a Part 100-type dose. You would use something less.

MEMBER BROWN: So it's -- effectively then that characterization is not unrealistic?

MR. SCHMIDT: That's true.

MEMBER BROWN: We are now going to say it's okay to have releases under accidents as opposed to not exceeding design limits under accident

conditions?

MR. SCHMIDT: Right. As long as they --

MEMBER BROWN: And I'm not talking about beyond design basis.

MR. SCHMIDT: Right.

MEMBER BROWN: I'm talking about design basis.

MR. SCHMIDT: That's correct.

MS. MAZZA: So also --

MEMBER BROWN: So that's what that means to me. And I didn't go on it the other day.

MS. MAZZA: Okay. So also in the Reg Guide we do say that that would probably be a policy decision.

MEMBER BROWN: Got it.

MS. MAZZA: Because it's different than--

MEMBER BROWN: Okay.

MS. MAZZA: -- others.

MEMBER BROWN: I'm sorry, did --

VICE CHAIRMAN CORRADINI: I want to make sure that we are clear. So can you -- can Jeff repeat what you are saying? Because I think Charlie -- what Charlie is saying back to you is not exactly the same that you said to him. I want to make sure that we're on the same page.

MR. SCHMIDT: I'm saying that there -- that the SARRDL concept does allow some dose release that has to meet certain dose criteria.

MEMBER BROWN: For the design basis accident?

MR. SCHMIDT: That's correct. For -- you know, the ARDCs and all these GDC-like things are only design basis criteria, so --

MEMBER BROWN: But whereas right now with the fuel design limits --

MR. SCHMIDT: Right.

MEMBER BROWN: -- that would be a zero really?

VICE CHAIRMAN CORRADINI: No.

MR. SCHMIDT: It --

MEMBER BROWN: No?

VICE CHAIRMAN CORRADINI: No. For DBA there is a specified --

MEMBER STETKAR: Right. You still have to meet these criteria.

MR. SCHMIDT: Yes.

MEMBER STETKAR: If you are less than that and that's not zero.

MEMBER BROWN: Hold it. You meet the -- but you don't fail the temperature limits under that,

correct?

MR. SCHMIDT: You have -- I don't want to speak for the staff, but I think the same limits are held in either case.

MEMBER MARCH-LEUBA: Yes, for example, for BWRs, the SAFDL is list on one -- .1 percent or otherwise fail. So you are allowed to operate with .1 percent or otherwise fail.

MEMBER BROWN: What about a PWR?

MEMBER MARCH-LEUBA: I don't know that, sir.

MEMBER STETKAR: It's the same. You can operate nuclear power plants with failed fuel rods.

VICE CHAIRMAN CORRADINI: Always have.

MEMBER STETKAR: And you can do that today. Always have.

VICE CHAIRMAN CORRADINI: It helps on burners.

MEMBER SKILLMAN: But, Charlie, I know you don't need a sermon, but --

MEMBER BROWN: No, I don't need.

MEMBER SKILLMAN: -- what you do is you're running your tech specs through your dose-equivalent iodine. And if you are within your VDI, you are allowed to continue and you do. Most smart operators

won't. At the first sign, they are going to come down because the consequence of running with extended chemistry isotopes is adverse to the whole plant, but you can. The tech specs let you do it.

MEMBER BROWN: Well, I'm probably not the only one that would look different to the way that is -- how -- in terms of the way it is characterized and what the reality is. I just --

MEMBER SKILLMAN: I can tell you I run a fuel cycle, I run a couple fuel cycles with weepers and I'll tell you what happens. It cleans out your condensate system and when you shutdown, it takes out your BWR state.

MEMBER BROWN: I understand. I'm just --

MEMBER SKILLMAN: But you are allowed to do it.

MEMBER BROWN: Dick, I come from some place where we didn't do that. Right? It's hard for me to wrap my brain around that one. Okay? It just doesn't sound like the right direction, but that's -- you answered my question and I'm satisfied now. No, I'm not satisfied. I understand what it means.

MEMBER MARCH-LEUBA: Okay. My concern that they raised on the Subcommittee with this is not the same as Charlie was -- his belief in this. I

don't see how you are going to implement this in reality.

MR. SCHMIDT: Right.

MEMBER MARCH-LEUBA: A SARRDL is a very good operational limit. When you are measuring the radioactivity you are getting, but during the design, from time to time, you are going to look at the fuel temperature and the cooling temperature and some conditions.

MR. SCHMIDT: Right.

MEMBER MARCH-LEUBA: And you are going to have to have a SAFDL that guarantees the SARRDL. So by doing this, you are making my life, as a licensee or as an applicant, more difficult.

MR. SCHMIDT: Right. I think that's what we are trying to capture. And your thought is that's what we tried to capture in the comments was you are looking for more SAFDL-like criteria that would be, say, time and temperature or other parameters which you could determine that would cause you to fail fuel.

MEMBER MARCH-LEUBA: For operation.

MR. SCHMIDT: Similar to SAFDL today.

VICE CHAIRMAN CORRADINI: It would be a surrogate, is what I would put --

MEMBER MARCH-LEUBA: Yes, sure.

VICE CHAIRMAN CORRADINI: -- is what I think Jose is --

MEMBER MARCH-LEUBA: Correct.

MR. SCHMIDT: Like we used 1 percent strain clad --

VICE CHAIRMAN CORRADINI: Yes.

MR. SCHMIDT: -- as a surrogate for a SAFDL today.

MEMBER MARCH-LEUBA: My claim is that this looks like very good, but when they go to design -- an applicant goes to design a reactor, they are going to have to use a SAFDL.

MR. SCHMIDT: Right.

MEMBER MARCH-LEUBA: And they are going to have to come to you for review for the SAFDL.

MR. SCHMIDT: Right.

MEMBER MARCH-LEUBA: Might as well call it a SAFDL from the beginning because that's what is going to get used.

MR. SCHMIDT: Right. And that's, I think. what we tried to capture in the comments by saying, you know, more specific criteria that would have to do with failure of the TRISO particle.

MEMBER MARCH-LEUBA: And, yes, for the record, so that from my calculation, from a paper

design, I know if it passes or fails.

MR. SCHMIDT: Right.

MEMBER MARCH-LEUBA: When it's not paper design, I don't know if the SAFDL passes or fails.

MR. SCHMIDT: One thing to consider, you know, we kind of have it under HTGR, is that, you know, for non-cladded fuel, I'm not sure what to describe as a SAFDL any more, right?

So we might be headed in this direction of a SARRDL anyhow, just don't lose that thought. And we are treating the TRISO particle like that, because we don't anticipate failures in the sense of loss of a lot of fission products when we have AOOs.

MEMBER MARCH-LEUBA: Yes.

MR. SCHMIDT: So that's why it's kind of lumped in. Technically, it has a clad, right, but we are going to come faced with some designs that don't have a clad fuel.

MEMBER MARCH-LEUBA: In principle, you make your SAFDL very, very high temperature that you never reach.

MR. SCHMIDT: I mean, it could be the vaporization of the fuel, I don't know, but that is probably not a realistic SAFDL.

MEMBER MARCH-LEUBA: What you are saying

is in this reactor we are never going to hit the SAFDL for the fuel. You will hit it for something else.

MR. SCHMIDT: Right.

MEMBER MARCH-LEUBA: But it won't be a SAFDL because it won't be --

MR. SCHMIDT: Right, it won't be a SAFDL, right.

MEMBER MARCH-LEUBA: Okay.

MR. SCHMIDT: That's right.

MS. MAZZA: Okay. So we are okay with containment design comments?

VICE CHAIRMAN CORRADINI: Are we now back on 16, because I have a question about --

MS. MAZZA: Well --

VICE CHAIRMAN CORRADINI: -- 16.

MS. CUBBAGE: No.

MS. MAZZA: Yes, we are back on 16, yes.

VICE CHAIRMAN CORRADINI: So I remember in the Subcommittee and I -- it's my fault for failing to write it down, I know that at least for the mHTGR, there was a document in which a containment function--functional containment performance requirement was suggested staff at least acknowledge this. And I wanted to get an idea of the name of the document in which that resided in, so I can trace it down.

MS. MAZZA: Okay. Sir, it would be in the reference section.

VICE CHAIRMAN CORRADINI: I think it's a white -- I thought it was a white paper that was sent to staff.

MS. MAZZA: Oh, you mean the NGNP?

VICE CHAIRMAN CORRADINI: Yes.

MS. MAZZA: Mechanistic Source Term?

VICE CHAIRMAN CORRADINI: So could you at least get it to our -- one of our Designated Federal Officials, so that we could look it up?

MS. MAZZA: Okay.

VICE CHAIRMAN CORRADINI: Okay. Because I think in the Subcommittee meeting, the point was that this seemed reasonable, but you are still going forward with some sort of policy discussion as to what would be an acceptable functional requirement. But I know there was from the DOE side for NGNP a suggestion.

MS. MAZZA: Yes.

VICE CHAIRMAN CORRADINI: Okay.

MS. MAZZA: Okay. Okay. Next is electric power, ARDC 17. So this was modified to place emphasis on requiring reliability of power sources rather than prescribing how such reliability can be

attained.

And the Member comments were:

Consider the importance of independence, diversity and defense-in-depth for electric power systems. Example, the lack of an offsite power requirement and clarify that vital functions include emergency lighting, radiation monitoring, communications, control room habitability and post-accident monitoring.

MEMBER BROWN: Didn't we have some comment, I don't -- this is vague, relative to you have got to be able to do something, have enough power to do something?

MS. MAZZA: So that's under vital functions, you mean?

MEMBER BROWN: Where -- yes. I have forgotten how it was. I remembered -- all I do is vaguely remember some discussion and I don't have the transcript, so I guess vital functions. It just says emergency lighting. It doesn't talk about maintaining some control of the plant, being able to do this, that or the other to either ensure rods are inserted or ensure you have certain pumps available or some other means that are undefined yet relative to any new plant that we get.

MS. MAZZA: Okay. So --

MEMBER BROWN: I mean, I don't know all the systems that may be necessary to maintain one of these plants in a safe shutdown condition, that's all.

MS. MAZZA: Okay. So it --

MEMBER BROWN: That's all.

MS. MAZZA: -- might be covered under vital functions. You just --

MEMBER BROWN: I guess it could, since you say include.

MEMBER STETKAR: I think the notion is that if you need a motor-driven pump to ensure long-term safety, then you have to have power for that motor-driven pump. If you need passive convective cooling without any forced flow, then you probably don't need power for any motor-driven pumps.

MEMBER BROWN: Yes.

MEMBER STETKAR: On the other hand, you may still need power for instrumentation in the control room to verify that, indeed, you have got flow and heat removal.

MS. MAZZA: Yes.

MEMBER STETKAR: The vital functions depend on the specifics of the design.

MEMBER BROWN: Yes, I agree with that.

MEMBER MARCH-LEUBA: An ACL will be on all components that were used, but were assumed available in the safety analysis.

MS. MAZZA: Right. So this is our GDC 17 electrical engineer. So do you want to speak to what the vital functions in your recollection?

CHAIRMAN BLEY: If I -- before you do, I was just looking back and they had -- you guys had a slide last time and it said something that included, I just lost it, power -- still need reliable power for monitoring habitability, lighting and communications. It's not in the document, but it was on your slide.

MS. MAZZA: That's right.

MEMBER STETKAR: That's the point. The slide sort of addressed everything, but that's a slide in a Subcommittee presentation. It's not --

MS. MAZZA: Okay.

MEMBER STETKAR: -- also not even --

MEMBER BROWN: I know. All right. I just didn't want to exclude based on whether the design was that you may have some function that you need to maintain and that seemed to be somewhat vague. I mean, these are specific. By listing the specific ones, they become a list and all-inclusive as opposed to exclusive. That's all.

I mean, we don't need to mess with this any farther, I just think vital function -- I think you just ought to think about that when you think about vital functions. And it's a function of the design of the plant. I mean, there is three or four different approaches, so it may or may not require some auxiliary thing other than that in order to maintain the condition. It should be addressed. That's all.

MS. MAZZA: Did you want to say something? No? Okay.

Moving on to reactivity control, that's ARDC 26 and 27 were merged into one design criteria. The design criteria includes a functionality to provide:

(1) A means of shutting down the reactor during normal operations and anticipated operational occurrences.

(2) And then a means of shutting down and maintaining safe shutdown during design basis events.

(3) And a system for holding the reactor subcritical under cold conditions.

And the design criteria appears to address control versus reactivity control. Consider renaming this design criteria and controlling the rate of

reactivity changes from planned normal power changes as currently described in GDC 26 should be addressed.

MEMBER SKILLMAN: I want to give you credit. I think you captured the essence of our comments on these last four or five criteria.

MS. MAZZA: Okay.

MEMBER SKILLMAN: Well-done. Thank you.

MS. MAZZA: All right. Thanks. Okay. Moving on to SFR-DC 73, Sodium Leakage Detection and Reaction Prevention and Mitigation. So it discusses the need to detect sodium leakage and to limit the extent of reactions with air and concrete and to mitigate fires resulting from reactions.

The comment was to consider the possibility of failure of steel-lined concrete SSCs due to heat up of concrete that results in steam forming between the steel and concrete and subsequent failure of the steel liner.

Good? Oh, okay. The next one, SFR-DC 74, Sodium/Water Reaction Prevention/Mitigation. It discusses the need to provide means to avoid contact between sodium and water. This includes steam water energy conversion -- the steam/water energy conversion system.

The comment was expand the design criteria

to include sodium reactions with working fluids of energy convergent systems other than steam and water.

Examples were carbon dioxide and nitrogen.

MEMBER POWERS: Will nitrogen actually react with the sodium enough to be considerable?

VICE CHAIRMAN CORRADINI: It's not as thrilling, but it reacts.

MS. MAZZA: Okay.

MEMBER POWERS: Well, if you form sodium azide, you probably have the potential of getting a little excitement.

VICE CHAIRMAN CORRADINI: The only -- I think I was the culprit in bringing this up. The only reason I'm aware of this is the French are studying all three potential fluid interacts, chemical reactions in their advanced systems.

MS. MAZZA: Okay. Cover Gas Inventory Maintenance, SFR-DC 79, discusses the need for a system to maintain the cover gas to ensure that primary coolant sodium design limits are not exceeded as a result of cover gas leakage.

And the comment was clarify whether this requirement also applies to the spent fuel pool. It was noted that in some SFR designs, the spent fuel is kept in the reactor vessel for one cycle. The staff

should consider how to address this in the design criteria.

Moving on, the mHTGR Technology Specific Criteria, 70-72, these technology specific design criteria address attributes of the modular high temperature gas reactor technology, such as reactor vessel, reactor system and reactor building structural integrity.

The comment was clarify that the geometric integrity of the reactor vessel and reactor system must be maintained during postulated accidents.

And I would note that this also overlaps with mHTGR-DC 34, which is Residual Heat Removal, because the residual heat removal has provided a -- geometry is important for the residual heat removal system.

MEMBER MARCH-LEUBA: Yes, I'm not sure exactly who wrote this up, but this looks a little too restrictive because what you have to maintain is a coolable geometry. I mean, the geometry might change a little bit and it will evaluate this, but you can stay cool and that might be acceptable. Think about it.

MS. MAZZA: Coolable geometry?

MEMBER MARCH-LEUBA: Coolable geometry.

MS. CUBBAGE: Coolable instead of maintained.

VICE CHAIRMAN CORRADINI: Can I just back up? I think the comment was, at least at the Subcommittee, that we were asking the question for the mHTGR and one of the staff's consultants answered that it's not the reactor cavity cooling system that is necessary. It's rather the geometry be maintained to remove decay heat to stay within temp -- appropriate temperature levels. And I think that's where Jose is going.

MEMBER MARCH-LEUBA: That was. The way I read this, if a cavity forms now, I change the geometry and you still cool the reactor.

VICE CHAIRMAN CORRADINI: It's just hard to -- well, I think that was the sense of the comment was is that the geometry has to remain enough intact so you can remove decay heat and stay within temperature limits.

MS. MAZZA: All right.

VICE CHAIRMAN CORRADINI: Otherwise you get past your SARRDL.

MS. MAZZA: Okay. Final slide is just some general comments.

Include language that does not preclude

the use of quantitative risk assessment for non-light water reactors.

Economy of words is not helpful for designers. Adding adjectives would be helpful. Example, independent in ARDC 17.

Consider historical experience from past designs. FERMI, for example.

Ongoing and future research may identify the need for additional design criteria.

Security considerations for non-light water reactor designs will be important due to the nature of heat removal systems that rely on a structural geometry to be maintained.

VICE CHAIRMAN CORRADINI: Okay.

MS. MAZZA: That's it.

VICE CHAIRMAN CORRADINI: Silence. You don't stop. If you are silent --

MS. MAZZA: Okay. So I am finished. So hopefully that is helpful for you all for your letter writing.

VICE CHAIRMAN CORRADINI: But if I might just go further, so with those comments, they will be pooled with the public comments and we will see a version some time in the -- you told Dennis and I forgot the date. Probably the end of summer?

MS. MAZZA: Yes, somewhere in there.

VICE CHAIRMAN CORRADINI: Okay.

MS. CUBBAGE: Well, let me just clarify. With the comments we get from the letter.

VICE CHAIRMAN CORRADINI: Of course.

MS. CUBBAGE: Yes.

VICE CHAIRMAN CORRADINI: Of course. Thank you.

MS. CUBBAGE: All right.

MEMBER MARCH-LEUBA: So let's look at the procedure. Shall we assume that all these comments have been implemented or we need to repeat them on the letter?

CHAIRMAN BLEY: We need to write the letter as we want the letter.

MEMBER MARCH-LEUBA: Sure. We write it the way we write it. Well, we talk about it later.

MS. CUBBAGE: So I think if there is things that you -- that are must dos, they need to be in the letter. Right?

MEMBER MARCH-LEUBA: Yes, but the way I was reading this is they already took our comments and they fixed it.

CHAIRMAN BLEY: We haven't made any comments as a Committee yet.

MS. CUBBAGE: Right.

MEMBER MARCH-LEUBA: They just --

MS. CUBBAGE: And nothing has been fixed.

CHAIRMAN BLEY: We just recorded the individual Member comments.

MS. CUBBAGE: Right.

CHAIRMAN BLEY: Yes.

MS. CUBBAGE: Okay. Finished?

CHAIRMAN BLEY: Who is up next?

MS. CUBBAGE: I am. So most of you, except for I think Mr. Stetkar, were here for most of the presentation yesterday. I'm calling you out there. I'm calling you out.

MEMBER STETKAR: So you had better be lucid, so that I can understand this.

MS. CUBBAGE: So my point is that yesterday we agreed that I would do a very abbreviated presentation, so we will kind of zip through this.

So just to lead in, we are seeing a lot of interest in non-LWRs, a big uptick in the last couple of years.

CHAIRMAN BLEY: Amy are you on? Is your mike on? I don't think so.

MS. CUBBAGE: All right. Thank you. Okay. So there is a lot of interest in non-LWR

designs right now and DOE has vision strategy with a goal of having at least two concepts ready for construction in the early 2030s.

NEI has a similar goal with anticipating demonstrations of one or more non-LWRs by 2025 and commercial availability of at least two designs by 2030 to 2035.

So in response to this growing interest, we are preparing for non-LWR reviews. And to guide our readiness efforts, we have prepared a vision and strategy document and our goal is to assure NRC readiness to effectively and efficiently review and regulate non-LWRs by no later than 2025, so that would mean that we would begin licensing in 2025 to support licenses in 2030, consistent with the DOE schedule.

And to achieve this goal, we have identified three objectives to enhance technical readiness, optimize regulatory readiness and optimize communications.

There are several companies that are looking to come to the NRC earlier than the DOE strategy would imply, so we are getting some feedback that our time line for readiness is too long. To address that, we revised our vision and strategy to make it clear that if we have individual applicants,

we will work with them and we may accelerate some readiness activities as needed to align with the needs of those applicants. We published that revised vision and strategy in December.

And then stemming from the vision and strategy, we have developed Implementation Action Plans to cover the 0 to 5 Year Near-Term Plan, Mid-Term and Long-Term Plans covering 5 to 10 years and beyond 10 years. And these strategies are supported by a number of specific contributing activities and supporting tasks.

The IAPs describe the detailed task to be performed and the associated resource estimates supports our budgeting process work planning and building our future staffing needs.

We have now published the mid, near and long-term IAPs for ACRS and stakeholder feedback and we are planning to finalize them later this spring.

Just to spend a little time on the Near-Term Implementation Action Plans, as we talked about yesterday, they span across six different strategies.

CHAIRMAN BLEY: Um --

MS. CUBBAGE: Please.

CHAIRMAN BLEY: -- at the Subcommittee, I thought -- I got the impression that you weren't

really going to revise them. You didn't want to spend your time doing that. Are you?

MS. CUBBAGE: It depends what we hear.

CHAIRMAN BLEY: Go ahead.

MS. CUBBAGE: Okay. Okay. So we have these six strategies and for those strategies we have activities ongoing in all areas. Some of the examples are we have Oak Ridge coming in to train us on molten salt reactors. We are in the early stages of Strategy 2 of identifying the available tools and trying to select what we would use doing some pre-PIRT activities.

In some cases we are further along in that area. The gas-cooled reactors, we have had a lot of experience with the NGNP review and we are much closer to knowing what tools we would use.

Strategy 3 involves a number of activities including the Advanced Reactor Design Criteria effort that Jan is leading, the Regulatory Review Roadmap, security design considerations, licensing basis event selection, so there is a lot of emphasis on Strategy 3 in the near-term.

Strategy 4, Industry Codes and Standards. We are actively involved in the ASME Section III, Division 5 efforts looking at high temperature

materials. We are actively involved with ANS Standard Committees looking at Non-LWR Standards and we are also looking at the Non-LWR PRA Standard to support the use of PRA and, in particular, the licensing basis event selection work will be relying on that standard.

Under Strategy 5, we are tackling some of the policy issues. So some of these are holdovers from the SMR policy issues, some of them come from the NGNP work. For EP there is a rulemaking ongoing for scalable emergency planning zones for small modular reactors and other technologies, including advanced reactors.

We are looking at the appropriate level of insurance that would be required in the future for designs with small source terms and lower consequences. We have a submittal in from NEI on consequence-based security that may eventually fold into a rulemaking, that is what NEI has requested. And we are also looking at siting issues if the source term --

VICE CHAIRMAN CORRADINI: Can you go back and say what was requested of you? I'm sorry.

MS. CUBBAGE: Say that again?

VICE CHAIRMAN CORRADINI: You said something was requested of you.

MS. CUBBAGE: Oh, in the consequence-based security paper from NEI that has now been sent to you, they are ultimately asking that that be a rulemaking to have --

VICE CHAIRMAN CORRADINI: Okay.

MS. CUBBAGE: -- different security requirements where you could justify different security based on the consequences of an accident of that design or the consequences of the sabotage event.

VICE CHAIRMAN CORRADINI: I see. Did you mention that in our Subcommittee meeting?

MS. CUBBAGE: I may not have said it in those exact words, but, yes.

VICE CHAIRMAN CORRADINI: And that's to be determined by --

MS. CUBBAGE: It's to be determined if we would initiate a rulemaking. Ultimately, that's something that would have to go to the Commission as a policy matter similar to how we did EP. There were information papers. Then there was a policy paper. And then the Commission directed the rulemaking on EP.

VICE CHAIRMAN CORRADINI: Okay. And then just one more piece, a quick question. So when you say security, we are talking?

MS. CUBBAGE: This is the security.

VICE CHAIRMAN CORRADINI: Okay. That's what I was -- versus EMD sensitive damage, management guideline initiatives for current reactors --

MS. CUBBAGE: Right.

VICE CHAIRMAN CORRADINI: -- versus how they would be designed out for advanced reactors? It's not manmade external threats. It is essentially physical security only?

MS. CUBBAGE: It's manmade security events.

VICE CHAIRMAN CORRADINI: But physical security versus --

MS. CUBBAGE: But not --

VICE CHAIRMAN CORRADINI: -- loss of --

MS. CUBBAGE: -- would not -- this is not the aircraft impact.

VICE CHAIRMAN CORRADINI: -- large areas?

MS. CUBBAGE: Or loss of large areas.

CHAIRMAN BLEY: It goes in yards, hard events.

MS. CUBBAGE: I missed that. What did you say?

CHAIRMAN BLEY: He said physical space.

MS. CUBBAGE: Physical space. Good.

CHAIRMAN BLEY: When you said they

requested, did they -- was there a formal request to the Commission or just in discussions they have said that they think it ought to be a rulemaking?

MS. CUBBAGE: The white paper actually--

CHAIRMAN BLEY: Okay.

MS. CUBBAGE: -- requests rulemaking.

CHAIRMAN BLEY: Okay. So it's normally requested.

VICE CHAIRMAN CORRADINI: That's what we talked about.

MS. CUBBAGE: Right. It didn't come in as a petition for rulemaking, but it came in as a proposal that could lead to a rulemaking.

CHAIRMAN BLEY: Oh, okay. It's not a formal petition. Okay.

MS. CUBBAGE: It's not a formal petition for the rulemaking.

MEMBER BROWN: We got the white paper last night. I didn't know if you knew that, that's why I said it.

CHAIRMAN BLEY: I did.

MEMBER BROWN: Okay.

CHAIRMAN BLEY: But I didn't know this part.

MEMBER BROWN: Okay.

MEMBER SKILLMAN: Amy, I guess I missed it yesterday, what is the difference in the issue of insurance and liability for an SMR versus a large P or a large B?

MS. CUBBAGE: It has to do with the consequence of accidents and the source term, so you would be looking at what would be the cost of an accident. Do you need to have the same level of coverage under Price-Anderson act.

MR. SEGALA: In Price-Anderson, there is two levels of insurance. There is a commercial insurance they have to get for something like $450 million. And then if the claims associated with that for an accident exceed the $450 million, the operator reactors pool money into a larger pool. I think they have to provide $121 million or something like that into that pool.

The -- for putting into the pool, that's limited to 100 megawatts-electric or greater. And so when NuScale came in, they were at 70 megawatts-electric and so, technically, they don't have to put into the pool. So likewise non-light water reactors also have a range of megawatts from very small to larger, so we are just looking at the whole insurance liability Price-Anderson. Is it --

MS. CUBBAGE: Equitable.

MR. SEGALA: -- equitable? Is it appropriate for non-light water reactors, NSMRs? There is also the NRR has to provide a periodic update every 15 years to Congress to talk about the health of the nuclear industry and Price-Anderson Act and make any recommendations for changes.

So the Office of New Reactors has been working with NRR to prepare for the report, which I think is due in 2021 or something like that.

MEMBER SKILLMAN: Okay. John, thank you. Amy, thank you.

MEMBER REMBE: Does NRC ever get involved with like the CSC International Fund that is sort of an international insurance for major -- for nuclear accidents?

MS. CUBBAGE: I'm looking at Bill. I'm not familiar with that personally.

MR. RECKLEY: This is Bill Reckley. The U.S. is part of that treaty.

MEMBER REMBE: Right. The U.S., but is -- does NRC participate in anything related to that treaty? They don't provide any assurances or anything?

MR. RECKLEY: Not that I'm aware of.

MEMBER REMBE: The companies that -- okay. Thanks.

MS. CUBBAGE: Okay. I think I was on siting. So if your source term could justify a significantly reduced siting area, there may be a policy issue if you are trying to site near a very densely-populated area. So that's an area we are considering.

We have already informed the Commission of this potential issue and we are going to be doing outreach with stakeholders this year.

And then on the communications front, we are planning our next DOE/NRC Workshop on April 25-26 at the Marriott across the street. We are having stakeholder meetings every six weeks. We are interfacing with DOE on implementing their GAIN program.

We have an MOU to provide regulatory support and to provide information on our regulatory programs.

And lastly on International Coordination, I chair an international group under NEA called the Group on the Safety of Advanced Reactors or GSAR and I'll be attending the GIF meeting, policy group meeting next month in Paris.

Briefly touching on pre-application activities, we have initiated pre-application interactions with Oklo. We had two meetings with them last year. Terrestrial has informed us that they plan to seek pre-application interactions prior to their expected 2019 application for design certification or construction permit for a Terrestrial 400 megawatt Integral Molten Salt Reactor.

We are instituting a core team approach, so we have a consistent group of reviewers that are coming to all these meetings to have efficient and effective interactions. And we do anticipate pre-application review starting with other applicants this year and next year.

So we have put a great emphasis on working with developers early in the pre-application interactions to develop licensing project plans, so that we can have a clear understanding of the expectations of what outcomes they want from the pre-application, what information we would need to achieve those outcomes and the schedule for those submittals and interactions.

A follow-up to yesterday's discussion, we want to make it clear that the Quality Assurance Program is one of the first submittals that we expect

to review for every pre-applicant. I don't think that quite came across yesterday.

MEMBER REMBE: No, no.

MS. CUBBAGE: But all of them will be submitting a QA description as one of their first submittals and I do believe someone here is from the QA Branch. I invited Kerri Kavanagh. I don't see her though. Oh, she is way in the back.

MEMBER BROWN: She is here.

MS. CUBBAGE: She is hiding in the back.

MEMBER BROWN: Yes, that is new information. And that is important information.

MS. CUBBAGE: But I want to be clear that that's -- and Kerri can help me on this, I mean, as to what the QA Plan -- what has to be done under Appendix B versus not is -- that's Kerri's specialty. But so the distance of a QA Plan doesn't necessarily dictate what is covered under that plan.

MS. KAVANAGH: Right. My name is Kerri Kavanagh. I'm the Chief of the Quality Assurance Vendor Inspection Branch III at NRO. Appendix B applies to applicants and to licensees. So in pre-application space, Appendix B requirements would only technically apply to the development of the design. Any information that would be used to support the

application would have to have some kind of quality controls and that's the kind of information we would be looking at for the Quality Assurance Program description.

The review of the QA Program is a high-level review. It's more like a technical report that we would review. We don't go into the implementing procedures until we get into inspection states and we will do some inspections in pre-application phase if they are doing testing to support their application. We will try to get our inspection teams out there to do an inspection of the vendor that is providing the data that supports the application.

MEMBER REMBE: So let's get specific. Do you have in the requirements they submit and their plan, will they say or do you insist that they say I will have an independent review of the way this design is developed?

MS. KAVANAGH: Appendix B doesn't require an independent review of how the -- design control allows for independent review of the design as it is being developed. There is a -- you know, you develop a design document and then you have a reviewer that verifies that the information is complete. But there is not an overarching statement that they have an

independent review of the overall design.

MEMBER REMBE: But --

MEMBER RAY: Appendix B says that their independent review can be by someone from the same organization, but is independent of the designer.

MS. KAVANAGH: Yes.

MEMBER RAY: Now, maybe another way to ask this question is at what point would information that is subject to confirmation or independent analysis by the NRC in its interaction with the potential application, at what point would a discrepancy in what the potential applicant has submitted trigger a requirement to look and see what caused that error or that discrepancy? That's one of the elements of an Appendix B program is when an error is discovered, you have to determine the extent of condition why it occurred and what other things may be affected by it.

At what point in this process we are talking about here would that be necessary?

MS. KAVANAGH: Well, that's a very good question and I don't think we have an established point until they become an applicant.

MEMBER RAY: Yes. That's -- and I understand why you say that and I'm not saying anything that is intended to say you are mistaken in

what you say.

But that's the essence of the problem that we are facing is that when it is a tension between when the Agency accepts something and we can all think of comments that return as a simple example, and then doesn't look at it ever again until somebody decides well, down the road where did that come from and asks a question and if that question is never asked, then it is never subject to -- never triggers what I'm talking about, which is well, how did you develop all this information?

So I think what we are going to struggle with is how to, at least what I will, feedback to you that there needs to be an understanding that when you submit something to the Agency, you have to stand behind it if it's submitted for the purpose of acceptance, approval, I don't know what know word to use, but this step-wise process it is sometimes described as, or if it's just indicative that well, the -- my responsibility as a potential applicant to go back and look at how any mistake that is identified occurred and what else may be affected by it, doesn't begin until I submit an application.

And until then, I can just float whatever balloons I want and you can respond to them as you

wish. And if you find one that I have made a mistake, I'll fix it and we'll go on. That's the thing that is troubling, I think, at this point.

VICE CHAIRMAN CORRADINI: Okay. I think I understand Harold's concern, but let me ask it specifically. At the Subcommittee yesterday, it was pointed out that if the staff were asked to do an assessment, not a topical report SE and not something that would lead to a preliminary safety analysis, but an assessment, does that trigger Appendix B or not?

In other words, they come in and they say here is our conceptual design and we would like you to do a design assessment. Is that -- those QA does it fall into this QA bin or is it pre-QA?

MS. KAVANAGH: Well, again, so --

MS. CUBBAGE: Pre-app.

MS. LUND: -- the pre-app. So readiness assessment type of thing?

MS. CUBBAGE: No, just pre-app like early pre-app interactions where they may come in and say here is part of our design. What do you -- you know--

VICE CHAIRMAN CORRADINI: What do you think?

MS. CUBBAGE: What do you think about this or you know?

MS. KAVANAGH: Yes. I mean, I don't think that hits the level of --

VICE CHAIRMAN CORRADINI: Okay.

MS. KAVANAGH: -- design being developed for the application.

VICE CHAIRMAN CORRADINI: I didn't think so. I'm just --

MS. CUBBAGE: If they ultimately --

MS. KAVANAGH: It's on the verge of consulting.

MEMBER RAY: Yes, I would agree with that. It's just -- but when does it is the thing that we can't put our finger on.

MS. KAVANAGH: Right.

MEMBER RAY: We can't --

VICE CHAIRMAN CORRADINI: But my --

MEMBER RAY: -- if it's not until the application is submitted formally as an application and thereafter, okay. But then everything that has happened up to that point in time is then, seems to me to be, necessary to reassess or reverify or something.

MS. CUBBAGE: But so, Kerri, the idea would be is if I'm a pre-applicant and I'm developing the design and this is stuff that I'm going to submit later, then that work needs to be done under Appendix

B.

MS. KAVANAGH: Absolutely.

MS. CUBBAGE: And they would have had an approved QA Plan to do it under. The question is what if they find an error, while they are doing that work under Appendix B to support a future application, are they required to do extent of condition, root cause?

MS. KAVANAGH: Their approved Appendix B program should have a corrective action mechanism already approved.

MS. CUBBAGE: Yes. So --

MS. KAVANAGH: And they should be implementing it.

MS. CUBBAGE: Yes. And so what Kerri is probably explaining is that our limitations to cite a pre-applicant for a violation not necessarily their obligations to follow their programs.

MEMBER RAY: Yes, no. There is no implication of what I'm saying at least about citations or anything of that kind.

MS. CUBBAGE: Okay.

MEMBER RAY: It's really the -- and we have had this experience somewhat, so I think it is not something just we imagine out of the ether. At what point are you now obliged to respond to any

problems that are found by yourself or by the Agency or by the member of the public, it doesn't matter, are you required to respond and say okay, what -- how did this happen? And the way it is supposed to be avoided is by independent review or testing. It doesn't have to be independent review, it can be testing, if I'm required to comply with Appendix B.

And if I'm not, in any case, it would seem like you would be obliged to say this is the only mistake that was made and there are no others. But again, I'm not trying to impose that at a time of interchange and dialogue that doesn't amount to acceptance by the Agency of any conclusion or any information as not subject to further review and verification. I'm wondering around too much, so I'll quit.

MEMBER REMBE: So just to make sure I understand, because maybe I'm slow in the legal language, for a pre-application assessment, one of the first things required is they have a submittal that describes their Quality Assurance Plan. And then once they have that plan, they need to adhere to it and that plan should include data or some sort of independent review of the design, right?

MS. CUBBAGE: I'm going to be -- I'm going

to give you a legalistic answer. They are not required to have pre-application at all.

MEMBER REMBE: Right.

MS. CUBBAGE: In the pre-application, they are not required to submit a QA program description.

MEMBER REMBE: Say that again. In the pre-application they are required?

MS. CUBBAGE: Not required.

MEMBER REMBE: They are not required.

MS. CUBBAGE: But if they are going to be doing work that is in support of the application, it needs to be under a QA program and they do --

MS. KAVANAGH: And it is highly recommended that it is submitted for NRC review and approval early, so that they have it to implement.

MEMBER REMBE: So highly recommended --

MS. KAVANAGH: There is no --

MEMBER REMBE: -- is about the best I can get.

MS. KAVANAGH: -- requirement for it.

MR. SEGALA: And we are telling the pre-applicants that information, that it is highly recommended to do that and we would --

MEMBER REMBE: Okay.

MS. CUBBAGE: If they go off and develop

stuff and it's not under Appendix B, you are going to have a real problem later trying to submit it to the NRC.

CHAIRMAN BLEY: How did --

MEMBER REMBE: And again, I would like to bring up the Canadian example, which their vendor review, designer review, one of the first things they require is this review of the processes, including the quality assurance. So, you know, if you love the Canadian way, it seems like that is one of the things they emphasize and so it seems like other folks are looking into that pretty early.

MS. CUBBAGE: I don't know the specifics of whether that is a legal requirement or how that all works.

MEMBER REMBE: Well, they don't have to also do their vendor design review. It's not part of the requirement of their regulator system, but again, if they go off and say this is a wonderful way of doing things, well, we could do that, too.

MS. CUBBAGE: But from a practical matter, all of the pre-applicants that are coming to us plan to come in with a Quality Assurance Program for our review and approval. That's from a practical perspective.

And at our workshop, we are going to have our QA folks out there explaining this.

MS. KAVANAGH: And it's expected that once you have it, you are going to implement that QA Program. However, what we do know of recent former applicants or assumed to be applicants or going to be applicants having an approved QA Program and never ended up using it. So but they have also dropped out of the SMR space. So it does happen, but the expectation from the NRC is that they are implementing their approved program.

MEMBER REMBE: Thank you.

CHAIRMAN BLEY: Now, there has to be, you know, if my little group and I get together and we work up a design and we work all by ourselves and we finally get something ready, this is pretty good. There has to be a way one can then retroactively apply a QA to go back over what you have done.

MS. CUBBAGE: Well, you would have to go back and --

MS. KAVANAGH: You would have to reconcile the calcs.

CHAIRMAN BLEY: Yes.

MS. CUBBAGE: -- verify the calcs.

CHAIRMAN BLEY: You would have to have

that independent review performed. So there is a path forward, however, you did this.

MS. CUBBAGE: If you go in and run a test program --

CHAIRMAN BLEY: It would be harder. It would be harder, yes.

MS. CUBBAGE: -- I'm sure it would be hard to go back and --

CHAIRMAN BLEY: Well, it would be on the test program, that's for sure.

MEMBER SKILLMAN: But it seems to me what has not been spoken here and needs to be spoken is when an applicant comes in and actually submits information on the docket, 50.9 or 52.9 apply.

MS. CUBBAGE: Right.

MEMBER SKILLMAN: And those little sentences in Pars 50 and 52 are almost not recognized by anybody.

MS. CUBBAGE: Well, they are -- the submittals that come into us are under oath or affirmation and I think the people signing those understand what that means.

MEMBER SKILLMAN: As long as that they do is the point I'm making.

MS. CUBBAGE: Yes, yes.

MEMBER SKILLMAN: For those who are not initiated --

MS. CUBBAGE: Right.

MEMBER SKILLMAN: -- that requirement is that what you have submitted is materially accurate in all aspects.

MS. CUBBAGE: Certainly. We rely on that.

MEMBER SKILLMAN: And you sign it and there is then the expectation say for Dr. Bley's example, a couple of people hatch a really nifty design, if they come in and apply on the docket, there is the presumption that what they have presented is materially accurate in all aspects.

MS. CUBBAGE: Absolutely. We rely on that.

MEMBER SKILLMAN: Okay. Thank you.

MEMBER KIRCHNER: Amy, may I ask a question?

MS. CUBBAGE: Sure.

MEMBER KIRCHNER: Under Strategy 3, the first green box is the regulatory roadmap. Is all of this going to be put in that? Is there a draft in development? And when would we see that?

MS. CUBBAGE: The regulatory roadmap is publicly available, the draft of that, and I think you

have it.

MEMBER KIRCHNER: Okay. We have that? All right. I didn't realize that. So where will you incorporate all this pre-application activity?

MS. CUBBAGE: So the pre-application --

MEMBER KIRCHNER: Are you doing it through -- just through your workshops or are you going to codify it in some manner that says this is what our expectation is? If you want to give us, engage us in the pre-application world, this is our expectation.

MS. CUBBAGE: So part of the roadmap, eventually, we would like to add on Rules of Engagement for how applicants would interact with us. I think NEI has planned -- I think they may have discussed that yesterday, that they are planning to develop some documents, we could fold those into an appendix, The Regulatory Review Roadmap. And we will continue to discuss these matters at our workshop and at our periodic every six week stakeholder meetings.

And then when we have pre-application meetings with specific applicants, we have these conversations leading to the development of a licensing program -- project plan.

MEMBER KIRCHNER: Yes. And you are going to rely on the industry helping its confederates along

in terms of developing licensing project plans. You are not going to --

MS. CUBBAGE: They have taken that --

MEMBER KIRCHNER: -- be prescriptive?

MS. CUBBAGE: -- on as an initiative and we would look at that and if acceptable to us, we could fold it into our guidance.

MEMBER KIRCHNER: Okay. Thank you.

MS. CUBBAGE: So that was all I planned to cover today.

MEMBER REMBE: Okay. Oh, I'm sorry, are you doing Slide 20?

MS. CUBBAGE: I wasn't really going to say anything other than that that's -- those are the topics we discussed yesterday.

MEMBER REMBE: So after we met yesterday, we received something from Steve through the staff and I don't know if you will discuss it later or should I bring it up?

MS. CUBBAGE: I don't know what Steve provided you.

MEMBER REMBE: For the record, okay, I had a lot of concerns, along with some of my colleagues, about the way Strategy 2 was -- the tasks identified with it. And we received something last night with --

because we were told during the meeting yesterday that the tasks outlined in Volume II had been changed. And we saw an updated version.

And I just wanted to make sure on the record that that was brought to --

VICE CHAIRMAN CORRADINI: We received what their request was for 2017.

MEMBER REMBE: Right. Well, their -- in the Volume II, there were tasks outlined for 2017 as well as 2018, 2019, all of every year. And anyway, 2017 that was in Volume II, there were some tasks that I personally had expressed a lot of concern about. And I saw the revised list last night and I thought that was a more reasonable approach for 2017.

And it's my understanding, and Steve can confirm it on the record, that that is a correct interpretation of what is being done now.

MR. SEGALA: But I think we have two things. We have what is in the Implementation Action Plan and then what Amy had alluded to yesterday as we have our execution strategies that we implement each fiscal year.

MEMBER REMBE: Yes.

MR. SEGALA: But we actually sit down and say based on the resources we have available today,

based on the relative priorities of the work on their plate, based on all sorts of things --

MS. CUBBAGE: Staff availability.

MR. SEGALA: -- staff availability, what can we actually accomplish this year? We had the Implementation Action Plans but now we have reality. Well, how much budget do we actually have? We had asked for the $5 million off the fee-base, but we haven't gotten that yet. So what Steve, I think, provided to you is what our execution strategy is for '17. And so --

MEMBER REMBE: So given my concerns that some of the tasks that were outlined in Volume II, even though they -- you didn't have funding for it and what is being done now seems more reasonable to me, then I guess my concerns about the -- I still think some of those tasks may not be the right thing to do until more knowledge of the path is traveled a bit further on where -- you know, do we really want to start developing codes for every possible design, at this time.

If you had all the money in the world, I don't think that would be a wise thing to do. And so I guess my concern remains, even though it seems like a more reasonable approach is being taken.

So I guess now I'm back to my comments, despite what I got last night, that's kind of where this discussion is taking me.

MR. SEGALA: Yes, I mean --

MEMBER REMBE: Yes.

MR. SEGALA: -- if that's a comment that you all have --

MEMBER REMBE: Yes, okay.

MR. SEGALA: -- then --

MEMBER REMBE: It's good that I brought it up, so I understood better, but you still stand behind all those tasks that are listed in Volume II?

MR. SEGALA: We stand behind those are things that need to be done in the five years and for the near-term and then we are looking at reality and we are working on what we can work on and what makes sense to work on. And then we reassess that every fiscal year and then anything that doesn't get done in the first five years would naturally move on to the 5 to 10 years.

MEMBER REMBE: Okay. So it's good I brought it up and I understand better what I saw. Thank you.

MEMBER RAY: Is there any way, I'm trying to think of -- trying to keep this short, but it comes

off what I think Joy was talking about, is there any way we can be really clear that what we do to review what is, I won't say submitted, but what is provided to us in these early stages, is not the verification of that information? And that ultimately, it's the applicant who must be responsible for that verification?

MS. CUBBAGE: I agree with you completely and I think that would be an appropriate type of thing for the Committee to put in a letter, so that -- to kind of advertise to the world that while we are doing these activities, that does not remove the obligation of any applicant to verify their design.

MEMBER RAY: Yes. And I'm not talking about when we do it, at this point, because I know that's a difficult process to decide, because when you wind up with Vendor Inspection Branch having to get involved and so on and so forth, then it's a pretty formal legalistic thing.

But it just seems like the potential applicants need to be aware that because it's a natural thing to think I came up with this design, I brought it in here, I paid you $260 an hour, you looked at it, you thought it was okay, what more do I need to do?

MS. CUBBAGE: Right.

MEMBER RAY: And that's the big problem that some of us are having, maybe all of us I don't know --

MS. CUBBAGE: Yes.

MEMBER RAY: -- with what we are describing here, because you are not relieved by paying $260 an hour from the obligation to validate the information that you provide as a basis for the -- ultimately for whatever you are applying for. And I just don't think that's clear. It's not anybody's fault. It's just a natural tendency to think that I brought you my design, you looked at it and said it was okay and that's all I need to do.

MS. CUBBAGE: Yes. It's clear in your minds.

MEMBER RAY: Well good. It is in ours, too, but, you know, it's a natural thing. I don't -- it just seems like in anything there needs to be a caveat down at the bottom of whatever we do. This does not relieve you of the responsibility, blah, blah, blah.

MS. CUBBAGE: All right. I'm done.

CHAIRMAN BLEY: That's great. Who is next? We just started at 2:00, didn't we? I guess we

don't need a break. Oh, do I have to wait for that? No, this isn't one of the formal agendas.

Please, come forward. How are you? Oh, I'm sorry, just a minute. Amy?

VICE CHAIRMAN CORRADINI: Amy?

CHAIRMAN BLEY: Oh, okay. That's right. Yes, we do. It wasn't reflected on here. Never mind. We had an agenda made up that doesn't quite match what we agreed on yesterday.

MS. CUBBAGE: Oh.

CHAIRMAN BLEY: You are all done.

MS. CUBBAGE: Thank you.

UNIDENTIFIED SPEAKER: Who is first on your paper?

CHAIRMAN BLEY: It's up to you guys who wants to be first. Is there an order that makes the most sense to you? Maybe Michael? You went first yesterday, right, of this group?

MR. TSCHILTZ: Good afternoon. It's nice to be back again today. We shaped our comments I think to hopefully provide more direct insights into what we think is most important, so with that, go to the next slide.

Okay. As we spoke before, I think we are all in favor of what the staff has done with the Near-

Term Implementation Action Plan. We think it improves the transparency of NRC's activities and support of licensing advanced non-light water reactors. We think the plan should be used in a way that it increases the efficiency and effectiveness of the licensing process resulting in more predictable scheduled cost and thus reducing licensing risk associated with a new application.

I also think that the plan should be a living plan, not just a snapshot in time. I think it significantly reduces the usefulness of the effort that was put in there to not maintain it and to update it as new things are learned and we progress. And then we look forward to working closely with the staff to integrate the activities and determine what is critical path and prioritize the efforts in order to best utilize the limited resources available to do the work.

So as we discussed yesterday, there is a large amount of work in the plan, probably more than what could be accomplished in the next years, so that highlights the need for prioritizing the activities. And I think from our perspective, Strategy No. 3 should be given the highest priority. It informs other activities, such as training and co-development.

We may be able to better focus our activities on things that are needed versus things may not be as important in the licensing process.

We also think Strategy 5 is important to pursue as a priority because the policy issues typically take longer to resolve and more work to do that. So those are the two strategies we think should be given the highest priority.

So conclusions are that we are ready to support the Near-Term Action Plan. Strategies 3 and 5 are the highest priorities from the industry's perspective. And that on top of that, as a part of Strategy 3, the staff should take advantage of the work that is being done and the utility-led licensing modernization project to make the licensing process more Risk-Informed, Performance-Based.

And that concludes my presentation.

CHAIRMAN BLEY: Thank you. Amir?

MR. AFZALI: Sure. As my presentation is coming up, my name is -- oops, let me put this on first. My name is Amir Afzali. I work for Southern Company, Licensing and Policy Director. To stay aligned with our NRC colleagues, I would like to welcome Mr. Stetkar joining us today. We missed you yesterday, so we are very happy that you are here.

And to fully benefit from your wisdom, I'm going to jump in directly to our observation and conclusion and then our recommendations and then say why we are making those recommendations.

In terms of observations, we believe IAPs are comprehensive submitted activities. It's not clear that near-term actions reduced the licensing risk adequately in a timely manner, and that more timely is stressed here. And the need -- although the need for Risk-Informed, Performance-Based licensing structure for advanced non-light water reactors has been identified, we have not taken concrete steps yet to get there and then the current time line is looking at 2026 time line, which we believe is a little bit too far away.

In terms of recommendations, we believe that Strategies 3 and 5 should be given the highest priority, particularly the licensing basis event selection. And then staff should be encouraged to continue the cooperation with the licensing letter for creating a Technology Inclusive Risk-Informed, Performance-Based licensing basis selection.

I want to stress that that approach is going to build on 20 years of previous work in this area, which was done by industry, NEI and NRC. And

there is a standard, ANS standard, the only approved Non-LWR Standard, ANS Standard 53.1.

Thank you. So in terms of why we should do it? You all like this image. It was produced by Jim, so I shamelessly copied it and with his permission before using it, and fundamentally, you all saw that everything we are going to do for our licensing, all the licensing inputs, all the tests we have to do, all the ARDCs we have to develop, mechanistic sources we have to calculate, every single thing depends on the bottom part, which is licensing basis event selection.

So the discussion earlier today with the staff clearly demonstrated that every single time you look at ARDCs there is a postulate that you are going to be behind it. And that's the licensing basis event selection.

So that's the reason we believe that should be -- take one of the highest priorities for the staff in modernization.

Next slide, please. Now, why should it be Risk-Informed, Performance-Based? Again, the key consideration is Chapter 15. Chapter 15 clearly states that you have to be risk-informed. There is a risk-informed in Chapter 15. Clearly, it tells you

that you have to consider frequency and you have to consider consequences. You have to differentiate between frequent events and relatively rare events, that's a requirement.

Given that is a requirement, there are only two options. Either you are going to do it in terms of prescriptive ad hoc process or you can use a performance-based systematic Risk-Informed, Performance-Based. And I used ad hoc Risk-Informed, Performance-Based approach. The current approach is Risk-Informed, Performance-Based, it's prescribed in an ad hoc. We are just trying to make it systematic way.

Next slide, please. So based on your questions yesterday, I tried to kind of show you what is it that when we believe this risk-informed -- systematic Risk-Informed, Performance-Based would provide you with a set of answers which are completely adequate.

So if you look at the ad hoc process, in terms of what is the process, for the process is based on -- I don't know, based on engineering judgment. The way you create your licensing basis event selection, the process is based on engineering judgment and prescriptive ANS Standard 15 point --

revisited in 15.1 and 15.2 and trying to adjust it for non-light water reactors.

In the systematic way, you do that plus you develop a PRA to add value to the previous engineering assessment. So in terms of process, the systematic Risk-Informed, Performance-Based is inclusive of the current process.

In terms of tools used, they typically use FMEA or they use phenomena identification, a ranking process, so that plus others like HAZOP and other FMEA methods are used in the PRA Risk-Informed approach. So again, the systematic Risk-Informed, Performance-Based is inclusive of the current ad hoc process.

In terms of frequency estimation this is just a qualitatively-based, based on engineering judgment, of the current process. Again, remember, you have to do that frequency estimate. It's not an option. You have to do.

In a systematic Risk-Informed, Performance-Based, you do a quantitative-based on applicable in-service data or engineering data as available.

In terms of uncertainty, no explicit identification of uncertainty in the ad hoc process. Again, in the systematic Risk-Informed, Performance-

Based is a systematic approach to talk about state of knowledge, model completeness, data completeness, etcetera. So there is a systematic process to deal with the uncertainty. And includes engineering judgment, which is part of that thought process.

So again --

CHAIRMAN BLEY: Amir?

MR. AFZALI: Yes, sir?

MR. AFZALI: I want to interrupt you. I think you said the non-LWR standard is actually approved and out on the street?

MR. AFZALI: 53.1. 53.1, which is for high temperature gas reactor.

CHAIRMAN BLEY: Just for the HTGR?

MR. AFZALI: Right.

CHAIRMAN BLEY: Okay.

MR. AFZALI: It's --

CHAIRMAN BLEY: I actually haven't seen that yet. And it has been approved?

MR. AFZALI: Yes, it was produced --

CHAIRMAN BLEY: Is that --

MR. AFZALI: -- approved about a --

CHAIRMAN BLEY: Well, I shouldn't ask you. I'll have to ask NRC if they have addressed it yet. I'm not sure that they have.

MR. AFZALI: They -- I'm going to let -- I know the answer, but maybe Jan can answer or the --

CHAIRMAN BLEY: Yes, but --

MR. RECKLEY: We did not endorse this.

CHAIRMAN BLEY: Okay. Is it on the table? Are you looking at it or do you know where it is?

MR. RECKLEY: As part of the going forward, we may revisit, but we made a conscious decision just to pass.

CHAIRMAN BLEY: To pass at this time. Okay. I haven't seen it yet. So go ahead. But I'm assuming that the focus on the FMEA is in HAZOPs and-- or part of that.

MR. RECKLEY: That's correct.

CHAIRMAN BLEY: And I think that is important, because you really got to come with a fresh mind and a fresh piece of paper on this one and not just try to replicate what has been done before.

MR. AFZALI: That's correct. And maybe I should answer this way then. Consideration and HAZOP are part of the PRA standard, ASME, non-light water PRA standard. So this -- and this may not discuss in detail what the PRA quality should be, but the ASME standard for the non-light water reactor PRA it does specify FMEA and the information that you put into the

PRA. Did that answer your question?

CHAIRMAN BLEY: Yes, thank you.

MR. AFZALI: Okay. So again, on technical adequacy, there are no consistent standards on how you do the licensing basis event selection, the ad hoc process. For a systematic Risk-Informed, Performance-Based, there is ASME standard, which is the standard is out for pilot process. It is being piloted right now. And there is EPRI research and there is current experience with high temperature gas reactor and the sodium cool reactor.

And I want to add to the fact that our project is actually going to exercise some portions of our project and show the results of applying our technology inclusive through a specific design.

So all that to show the technical adequacy of that approach. And I want to again highlight the difference between the systematic Risk-Informed, Performance-Based approach and the ad hoc Risk-Informed, Performance-Based approach, which is currently used.

So we believe there is a significant benefit in the systematic way.

Next slide, please. And the other questions I had yesterday is, again, where do you use

the PRA? Complete the PRA should be able to provide you with reasonable answers. Again, we haven't completed our work in that area.

However, that question has been asked before and has been answered a couple of times and, basically, this is again from the previous work done in this area. And as you can see, you can do PRA as conceptual stuff -- stage at the pre-conceptual for limiting final and continuously update your PRA.

And your performance criteria plus your risk insight plus your engineering judgment make sure that you stay within a certain performance.

CHAIRMAN BLEY: That's a good slide in the sense that it makes it clear. Two things, it makes two things clear. One is that this can be useful at all stages of development.

The second is there is a certain risk one takes in following this approach and that is as you go later, you might find you have to come up with new LBEs that you hadn't thought of before that could cause you to make new -- need new systems or something. It's a learning process as you go through it.

So I like this. Thank you. I'm glad you brought this today. It helps.

MR. AFZALI: Okay. Excellent. That's all I have, so if there are any questions regarding. Thank you.

CHAIRMAN BLEY: Anything from anyone else? Peter, go ahead.

MR. HASTINGS: Okay. Also in the interest of time, I'm going to skip a lot of what you guys heard yesterday, because everybody was here for the vast majority of it.

CHAIRMAN BLEY: Pass the microphone.

MR. HASTINGS: Better?

CHAIRMAN BLEY: Better.

MR. HASTINGS: Thank you.

CHAIRMAN BLEY: You will be on the transcript now.

MR. HASTINGS: Okay. So you recall NIA produced a document about a year ago and one of the areas of emphasis which the Committee talked about at some length yesterday was stage licensing. I want to recap some of that.

But before I do, I want to address some of the discussion in a prior session and hopefully the Committee won't find this too gratuitous. But if I can be so bold to speak on behalf of the industry, we absolutely understand that we own the responsibility

for preparation, review and approval of the entirety of our licensing basis.

We take zero credit for NRC or ACRS review in our QA program or any other design control program. We understand that unambiguously. There are entire sets of regulations written around that. We understand that very clearly. Certainly, if the Committee wants to say something to reinforce that in a letter, I wouldn't dream of trying to dissuade you of that.

I would just caution you to be careful that you don't leave the impression that someone has hinted otherwise, because we absolutely, at the industry level understand that.

CHAIRMAN BLEY: Someone may have hinted that.

MR. HASTINGS: And if they have, certainly, absolutely, I wouldn't --

MEMBER RAY: I think you are very good in what you said, Peter. I take it absolutely as the case. The thing goes beyond though just literally what you said to the point of responsibility also for not just the accuracy of specific points in the design, which, of course, you would expect responsibility for, but the responsibility for

responding to any discrepancies that are identified by looking at the other points to verify that they aren't subject or whatever the problem was that caused the one issue.

MR. HASTINGS: Yes.

MEMBER RAY: That's really the essence of it.

MR. HASTINGS: And I agree entirely and that's fully embedded in the criteria associated with corrective action.

MEMBER RAY: Yes. And we can't enforce that prior to the time at which an application is submitted. We just don't want to mislead by saying well, you looked at it, we looked at it, there was a mistake here, but we fixed it now and go on. That's just not the way it should be.

MR. HASTINGS: Understood. And certainly it never hurts to reinforce that, but we do very clearly understand. I wanted to --

MEMBER RAY: Thank you for saying that.

MR. HASTINGS: -- thank you for putting my mind at ease.

Similarly, 50.9, 52.6 requires complete and accurate information, that is much broader than the QA program. That is for every aspect of ever

submittal. So we understand that as well.

Okay. So we were talking about stage licensing and the three aspects that NIA has discussed.

The first being the conceptual design assessment. We talked about this at length yesterday and no need to rehash it in the absence of questions, except to point out that -- to reiterate some of the discussion on whether the QA program is part of that or not. The QA program applicability is required at the time of developing design basis information associated with safety-related SSCs.

Clearly, it is -- it can't be a required review under a part of review regime that is not self-acquired. So for example, if the VDR isn't required in Canada, then review of the QA program must not be required, because that's the -- at least in advance of the application submitted.

MEMBER REMBE: But in Canada, from the documentation they gave us, that's the first thing they look at a review of the QA process.

MR. HASTINGS: It is a highly recommended piece that they look at, just as it is with the NRC.

MEMBER REMBE: Well, the whole VDR isn't but, again, are you sure you have talked to the

Canadians and they -- that's -- even though it is said in their viewgraphs, this is the first thing we look at under the VDR?

MR. HASTINGS: It is. As a matter of -- and I'll -- let me do this. I'll confirm my assertion just to make sure, but --

MEMBER REMBE: Yes.

MR. HASTINGS: -- there is a list of topics that they make eligible for VDR, that is one of them. It is prominent. It is standard practice that that's one of the first things that they look at just as it is in terms of QA topicals at the NRC.

VICE CHAIRMAN CORRADINI: But to be clear, it's not required. It's highly recommended.

MR. HASTINGS: Correct, correct.

MEMBER REMBE: With the -- that's obviously from the viewgraphs. I haven't talked to a Canadian regulator yet.

MR. HASTINGS: And I'll confirm that to make sure.

MEMBER REMBE: Yes, that would be good to --

MR. HASTINGS: But I believe that is the case.

MEMBER REMBE: -- see that.

MR. HASTINGS: And certainly in the U.S., not a requirement. Pre-application engagement isn't a requirement. Topical reports in advance of an application aren't a requirement. But they are a really good idea. And the vast majority of people do it and the vast majority -- let me be even clearer. Everyone I have spoken to understands the need to apply these QA programs at a point in the design where you are not -- where you don't want to risk having to go back and redo work, because that's the risk.

You produce a bunch of analysis outside of the QA program, you can't take credit for it in developing your licensing basis. You just can't. You have to redo it. Now, redoing it may be complicated, it may be easy depending on the scope, but just as it wouldn't necessarily make sense to apply the full rigor of a QA program to scoping analysis and pre-conceptual design, it also wouldn't make sense to start developing bona fide design basis information outside the QA program because you are wasting money that you will have to spend later to go reproduce it under a QA program.

MEMBER REMBE: Okay. Again, if it's private money and they pay for everything with the regulator, I -- it is none of my business, but when it

has been coming out of the tax base and to review these designs, it sure seems like somebody ought to be requiring it so public money isn't wasted.

MR. HASTINGS: Well --

MEMBER REMBE: But that's in independent view of --

MR. HASTINGS: Well, review money comes from the applicant.

MEMBER REMBE: Pardon?

MR. HASTINGS: Review money comes from the applicant.

MEMBER REMBE: Yes, but if they are doing the off-fee base --

MR. HASTINGS: True. That's right.

MEMBER REMBE: -- the $5 million, it sure seems like somebody ought to be. I don't know.

VICE CHAIRMAN CORRADINI: I think there is a clarification.

CHAIRMAN BLEY: Wait for the mike here.

MS. CUBBAGE: Under the current --

CHAIRMAN BLEY: You are? You are?

MS. CUBBAGE: Amy Cubbage, NR staff. Under current fee structure, the off-fee base money would be only for generic NRC infrastructure work. Any pre-applicant is billed directly for the work that

we do on their behalf.

MEMBER REMBE: But -- okay. But you are having to go off the fee structure and talking about getting codes for doing sodium reactors, gas coolants.

MS. CUBBAGE: Yes, that's a different story.

MEMBER REMBE: Yes, yes. I mean, it's indirectly the tax payers --

MS. CUBBAGE: I just wanted to make --

MEMBER REMBE: -- paying for it. But again, it's one person's view.

MS. CUBBAGE: But that would be --

MEMBER REMBE: It's not my --

MS. CUBBAGE: -- generic to all reactors, not to a specific one.

MEMBER REMBE: Technology, yes.

MR. HASTINGS: Okay. So let's move on to standard design approval. Again, we talked about this at some length yesterday. The work is underway today to define what a major portion means. We had good discussion. We got some good feedback and we'll certainly fold that in to our -- the paper that we are developing. And I suspect at some point it will come to the ACRS for review as well.

The Licensing Program Plan, again, we

talked about this at some length yesterday, establishes a really good platform for communication between the applicant and the staff on how pre-application interactions are going to go, whether, for example, we are going to take advantage of a conceptual design assessment or not, what topical reports we are going to produce and when, various aspects of project management associated with that and what kind of application path the -- a particular design is going to take.

So we continue to work in that lane as well and look forward to continued progress.

VICE CHAIRMAN CORRADINI: Can I take you back to your third bullet?

MR. HASTINGS: Sure.

VICE CHAIRMAN CORRADINI: You mentioned yesterday, and maybe you said it, I was off-duty, there was a paper being prepared or something, a white paper being prepared by the industry as a whole, by his task force or NIA?

MR. HASTINGS: It's by NIA. It will get the broader industry review through NEI.

VICE CHAIRMAN CORRADINI: When the time is appropriate, I think it would be -- we would like to see that.

MR. HASTINGS: Yes, I -- that's my expectation as well.

VICE CHAIRMAN CORRADINI: Okay.

MR. HASTINGS: Near-Term IAPs. I'll, again in the interest of time, just reiterate the conclusions from others in industry. We think that Strategy 3 and 5 have the highest priority for all the reasons that have been previously stated. We talked yesterday about our interest in expanding Strategy 2, albeit not necessarily expanding it beyond what was further derived in the Volume II IAPs. We think it is a pretty comprehensive list and there has, obviously, been discussion about the puts and takes on when those should be prioritized and for what reason.

I do want to clarify somewhere -- oh, one of my bullets here. I misunderstood or misread a part of Volume II for Strategy 5 where all the policy issue resolution -- I had interpreted something that was written. It was meaning of Law Plan for FY27. My error, my mistake. I apologize for the mistake in the bullet.

It doesn't do anything to reduce our support for it and enthusiasm for timely resolution of policy issues. So I believe that is it. So we think things are going well. We will continue eagerly to

work with the staff on both the strategy level and for the various aspects of stage licensing. Thank you again for your time.

MEMBER REMBE: So I would really again, I am looking at some viewgraphs, I would really appreciate you confirming this. I'm looking at some viewgraphs that were presented by this -- the Canadian Nuclear Safety Commission on October 2016. And the primary focus in the viewgraphs they say the very important point, the primary focus of a VDR, Vendor Design Review, is on the vendor's Integrated Management System Processes used to develop a high quality design configuration. And it elaborates on that, so if you could give us a quotable source that says no, they don't have to do that, I would really appreciate it.

MR. HASTINGS: I'll be happy to do that.

MEMBER REMBE: Thanks.

CHAIRMAN BLEY: Are there any more questions from any of the Members? Gentlemen, thank you very much.

We are going to ask now if there are any public comments. Is there anyone in the room who would like to make a comment?

Is there anyone on the phone line who

would like to make a comment? If so, please, identify yourself and make your comment.

Okay. Thank you. We -- I've lost my agenda for today. What? Well, not quite. At this point, we are going off the record, but I want the Members to stick around for a minute.

Off the record.

(Whereupon, the above-entitled matter was concluded at 3:32 p.m.)

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Cost-Benefit Guidance Update

ACRS Full Committee Meeting
March 9, 2017

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Purpose

- Discuss proposed changes made to:
  - NUREG-1530, “Reassessment of NRC’s Dollar per Person-Rem Conversion Factor”
  - NUREG/BR-0058, Revision 4, “Regulatory Analysis Guidelines of the U.S. NRC”

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Background

- Fukushima Dai-ichi accident initiated questions regarding how NRC considers potential economic consequences (EC) of a nuclear accident
- SECY-12-0110, “Consideration of EC within the U.S. NRC’s Regulatory Framework”
- Staff Requirements Memorandum (SRM)-SECY-12-0110
  - SECY-14-0002, “Plan for Updating NRC’s Cost-Benefit Guidance”
  - SECY-14-0143, “Regulatory Gap Analysis of the NRC’s Cost-Benefit Guidance and Practices”

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Background (cont'd)

- SRM-SECY-12-0157, "Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments"
  - SECY-14-0087, "Qualitative Consideration of Factors in the Development of Regulatory Analyses and Backfit Analyses"
- Government Accountability Office (GAO) Audit Report Findings
- Office of Inspector General (OIG) Audit Report Findings

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NUREG-1530, Revision 1, "Reassessment of NRC's Dollar per Person-Rem Conversion Factor Policy"

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Dollar per Person-Rem

- ***Definition:*** This factor translates radiological dose "to a monetary value and, as such, allows for direct comparison between the potential health and safety benefits and the costs of a proposed regulatory initiative."
  - 60 FR 65694
- In short, dollar per person-rem is the dollar-value of the health impact of radiation dose.

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Background

- The NRC first used a dollar per person-rem value in 1974. The value set was $1,000 per person-rem.
- This value was revisited, resulting in the publication of NUREG-1530 in 1995, which established a value of $2,000 per person-rem and separated the offsite economic consequences from this factor.
- In 2009, the staff began research to update the dollar per person-rem value.
- SECY-12-0110 indicated that the staff would update guidance documents relating to cost-benefit analyses, including NUREG-1530. The Commission approved the staff's recommendation in 2013.

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Calculating Dollar per Person-Rem

How is dollar per person-rem calculated?

- The NRC multiplies a current VSL by a cancer risk coefficient.
- NUREG-1530, published in 1995, uses a VSL of $3 million and a cancer risk coefficient of 7.0×10^{-4} per person-rem from International Commission on Radiological Protection (ICRP) 60 published in 1991. This approximates a dollar per person-rem value of $2,000.
- Currently, NUREG-1530 does not provide a method for adjusting this value into real dollars.

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Proposed Changes to NUREG-1530

- Update the dollar per person-rem conversion factor from $2,000 to $5,200 per person-rem for the best estimate.
- Vary the dollar per person-rem conversion factor by plus or minus 50%, resulting in low and high values of $2,600 and $7,800 per person-rem, respectively.
- Report dollar per person-rem factor to two significant figures.
- Propose methods for maintaining the dollar per person-rem conversion factors.
- Provide guidance to staff on when to use the dose and dose-rate effectiveness factor (DDREF).

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Value of a Statistical Life (VSL)

- VSL concept used widely throughout the Federal government to monetize the health benefits of a safety regulation.
- VSL is **NOT** a value placed on a human life, but a value that society would be willing to pay for reducing health risk.
- NRC utilizes the willingness-to-pay (WTP) method for calculating VSL, consistent with other Federal agencies.
- NRC used the research done by other Federal agencies in calculating VSL.
- The NRC staff applied a best estimate VSL calculation of $9 million in 2014 dollars in NUREG-1530, Revision 1.
  - This estimate is derived from the average of the Department of Transportation's (DOT's) VSL ($9.3 million) and the Environmental Protection Agency's (EPA's) VSL ($8.7 million) in 2014 dollars.

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Basis for VSL Sensitivity Analysis

- The NRC has adopted the EPA practice to use a central VSL estimate without a probability distribution.
- This practice is consistent other Federal agencies practices in the use of VSL, notably:
  - EPA guidance states, “Until updated guidance is available, the Agency determined that a single, peer-reviewed estimate applied consistently best reflects the SAB-EEAC advice received to date.”
  - DOT guidance prescribes “a sensitivity analysis of the effects of using alternative VSL values. Instead of treating alternatives values in terms of a probability distribution, analysts should apply only a test of low and high alternative values…”.

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Cancer Risk Coefficient

- NUREG-1530 (1995) uses the cancer risk coefficient value from ICRP 60, published in 1991, of 7.0×10^{-4} per person-rem.
- ICRP 103 (2007) presents an updated cancer risk coefficient of 5.7×10^{-4} per person-rem.
- In 2011, the EPA published a cancer mortality risk coefficient of 5.8×10^{-4} per rem (90% confidence interval: 2.8×10^{-4} to 1.0×10^{-3}).
- Based on public comments received, the staff selected the EPA's cancer mortality risk coefficient.

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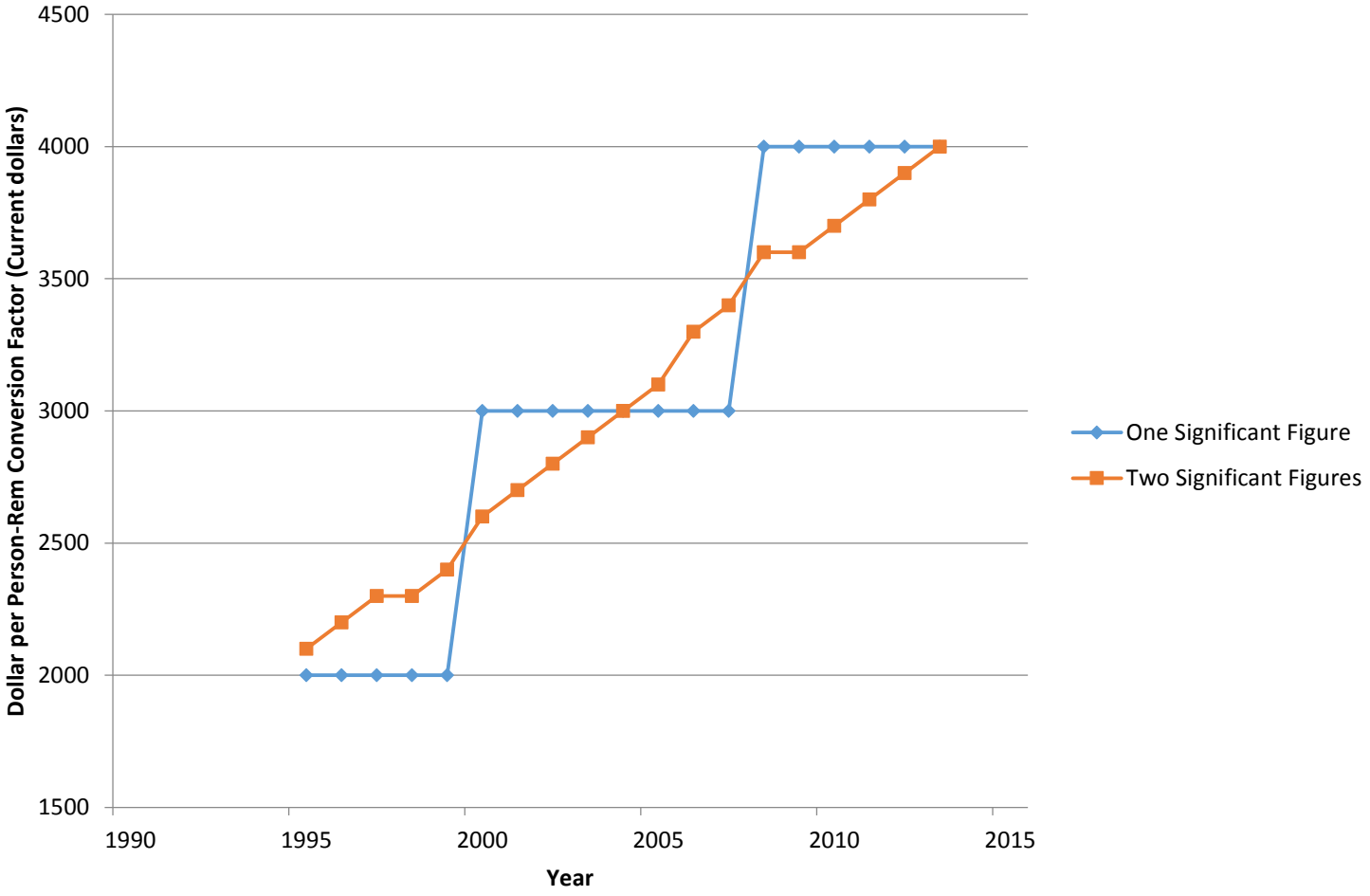
Effect of Two Significant Figures



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Methodology for Keeping Factor Current

- NRC proposed formula for keeping the dollar per person-rem factor current is:

$$\text{Dollar per Person-Rem}_{\text{current year}} = (\text{Dollar per Person-Rem}_{\text{base year}}) \times (\text{Inflation}) \times (\text{Real Income Growth})^{\text{Income Elasticity}}$$

- The staff would inform the Commission if the EPA adopts a new cancer mortality risk coefficient.
- The staff would reevaluate its baseline values for VSL and cancer mortality risk coefficient periodically and provide a recommendation to the Commission whether to update guidance and regulations if the conversion factor is expected to change by more than $1,000 per person-rem.

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Dose and Dose Rate Effectiveness Factor (DDREF)

- Intrinsic to the EPA cancer mortality risk coefficient is a judgment that the per person-rem health detriment below certain doses and dose rates would be lower by a factor of 1.5, compared to the higher dose and dose rates where human health effects have been observed.
- This factor is called the DDREF and is included in the EPA cancer mortality risk coefficient and the NRC staff's proposed dollar per person-rem conversion factor.
- This factor would be removed for special cases involving high dose or high dose rates.

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NUREG/BR-0058, Revision 5, "U.S. NRC Regulatory and Cost-Benefit Analysis Guidance"

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Two-Phased Approach

- Phase 1 – Administrative and methodology enhancements
  - Revise and restructure documents (NUREG/BR-0058 and NUREG/BR-0184, “Regulatory Analysis Technical Handbook”)
  - Refocus and expand guidance on cost-benefit analysis across the agency
  - Update data, methods, and references
  - Address audit findings and case study recommendations

- Phase 2 – Address potential changes in policy and methodology and maintain/update guidance
  - Further refinement of cost estimate values
  - Process for addressing emergent policy issues identified by gap analysis
  - Consequence and probabilistic methodology review
  - MELCOR Accident Consequence Code System (MACCS)
  - Periodic review of cost-benefit guidance

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Proposed Changes

- Refocuses and expands guidance on cost-benefit analysis across the agency.
- Focuses on quantification and methods for creating realistic estimates.
- Provides methods for assessing factors that are difficult to quantify.
- Incorporates cost estimating best practices.
- Expands on the treatment of uncertainties.
- Enhances transparency of analysis for the decisionmaker.

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Changes Following Subcommittee Meeting

- Disclaimer added to Table 2-1, Table 5-1, and Table 5-2, in the main document, that the tables will be updated and moved to Appendix H in Phase 2.
- Section A.4.4 Bounding Analysis in Appendix A was revised.
- Table B-2 in Appendix B was reviewed. The table is sourced from GAO-09-3SP, therefore no change was made.
- Enclosure B-4 to Appendix B will be completed in Phase 2.
- Figure C-2 in Appendix C was revised to reduce the number of significant figures on the graph.
- Figure C-3 in Appendix C was revised to show the 95% and 5% confidence levels and the mean.

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Cost Estimating and Best Practices

- Characteristics of a high quality cost estimate
  - Credible
  - Well-documented
  - Accurate
  - Comprehensive
- Improvements in cost estimating practices
  - Expand guidance to incorporate cost estimating best practices
  - Describe methods and procedures recommended for use in preparing cost estimates that are specific to all NRC work
  - Describe practices relative to estimating life cycle costs

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Treatment of Cost Estimate Uncertainty

- Past NRC Regulatory Analysis
  - Point estimates
  - Sensitivity analysis on a case-by-case basis
  - Infrequent use of uncertainty analysis
- Current Regulatory Analysis
  - Parametric estimates
  - Sensitivity and uncertainty analyses
  - Revised guidance reflects this new approach

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Qualitative Factors Assessment Tools

- Establishes a structured process for when quantification is not practicable
- Provides guidance and best practices for use in evaluating qualitative factors
- Provides a number of standard methods
- Increases transparency and consistency

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Status and Next Steps

- 60-day public comment period - April 2017
- Goal is to issue document for use by March 2018
- Phase 2 begins after March 2018 issuance of document

Backup Slides

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Acronyms

ADAMS	Agencywide Documents Access and Management System
DDREF	Dose and dose rate effectiveness factor
DOT	U.S. Department of Transportation
EC	Economic consequences
EPA	U.S. Environmental Protection Agency
FR	Federal Register
GAO	U.S. Government Accountability Office
ICRP	International Commission on Radiological Protection
MACCS	MELCOR Accident Consequence Code System
ML	Main library
NUREG	NRC technical report designation
OIG	Office of the Inspector General
SAB-EEAC	Science Advisory Board – Environmental Economics Advisory Committee
SRM	Staff Requirements Memorandum
VSL	Value of a Statistical Life
WTP	Willingness to Pay

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References

- DOT, 2014, Guidance on Treatment of the Economic VSL in U.S. DOT Analyses – 2014 Adjustment
- EPA, 2014, Guidelines for Preparing Economic Analyses
- GAO Audit Report, GAO-15-098
- GAO Cost Estimating and Assessment Guide, GAO-09-3SP
- ICRP 60, 1991
- ICRP 103, 2007
- NUREG/BR-0058, Rev. 4 available at ML042820192
- NUREG/BR-0058, Rev. 5 available at ML17023A180
- NUREG/BR-0184 available at ML050190193
- NUREG-1409 available at ML032230247
- NUREG-1530 available at ML063470485
- NUREG-1530, Rev. 1 available at ML17018A239
- OIG Report OIG-15-A-15, Audit of NRC's Regulatory Analysis Process available at ML15175A344

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References (cont'd)

- SECYs
  - available at http://www.nrc.gov/reading-rm/doc-collections/commission/ or in ADAMS
  - SECY-12-0110 available at ML12173A478
  - SECY-14-0002 available at ML13274A519
  - SECY-14-0087 available at ML14127A458
  - SECY-14-0143 available at ML14280A426
  - SRM-SECY-12-0110 available at ML13079A055
  - SRM-SECY-12-0157 available at ML13078A017
  - SRM-SECY-14-0087 available at ML15063A568

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Qualitative Factors

Commission direction SRM-SECY-14-0087

The focus of the update should be on capturing best practices for the consideration of qualitative factors.

- The updated guidance should provide a toolkit to the analysts to help them clarify their thinking with regard to how they considered qualitative factors.
- The guidance should support regulatory analyses that clearly present the analyst's consideration of qualitative factors in a transparent way that decisionmakers, stakeholders, and the public can understand.
- The updated guidance should not be overly complicated or prescriptive in such a way that would hinder decisionmaking.

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Qualitative Factors (cont'd)

- NRC guidance notes that even inexact quantification with large uncertainties is preferable to no quantification
- Staff qualitatively considers factors in regulatory analyses and backfit analyses for various reasons
- Current practice consistent with NRC guidance and Commission direction
- NRC Risk-Informed Decisions
- Adequate Protection Determinations
- Cost-Justified Substantial Safety Enhancements

Removing Barriers for Advanced Reactor Deployment Through Modernization of Regulatory Framework

Amir Afzali

Licensing and Policy Director – Next Generation Reactors

Southern Company Services

ACRS Future Plant Designs Subcommittee

March 9, 2017

Southern Company

Observations and Recommendations

- Observations:
  - IAPs provide a comprehensive list of needed activities
  - It is not clear that the near term actions reduce licensing risk adequately in a timely manner.
  - The need for a Risk-Informed, Performance-Based (RIPB) licensing structure for advanced non-LWR reactors was identified many years ago (1990s) and has been reemphasized recently (e.g., SECY- 15-0168) yet the NRC projected time lines for developing RIPB are well into the future (2026+)
- Recommendations:
  - Strategies 3 and 5 should be given the highest priority, particularly the Licensing Basis Event (LBE) Selection Process.
  - Staff engagement with the industry to develop a systematic Technology Inclusive Risk-Informed, Performance-Based (TI-RIPB) LBE selection process should be supported.
    - Build on over 20 years of previous work by industry, NEI, and NRC such as NGNP, NUREG 1860, ANS standard ANS 53.1 ("Nuclear Safety Criteria for the Design of Modular Helium Cooled Reactor Plants"

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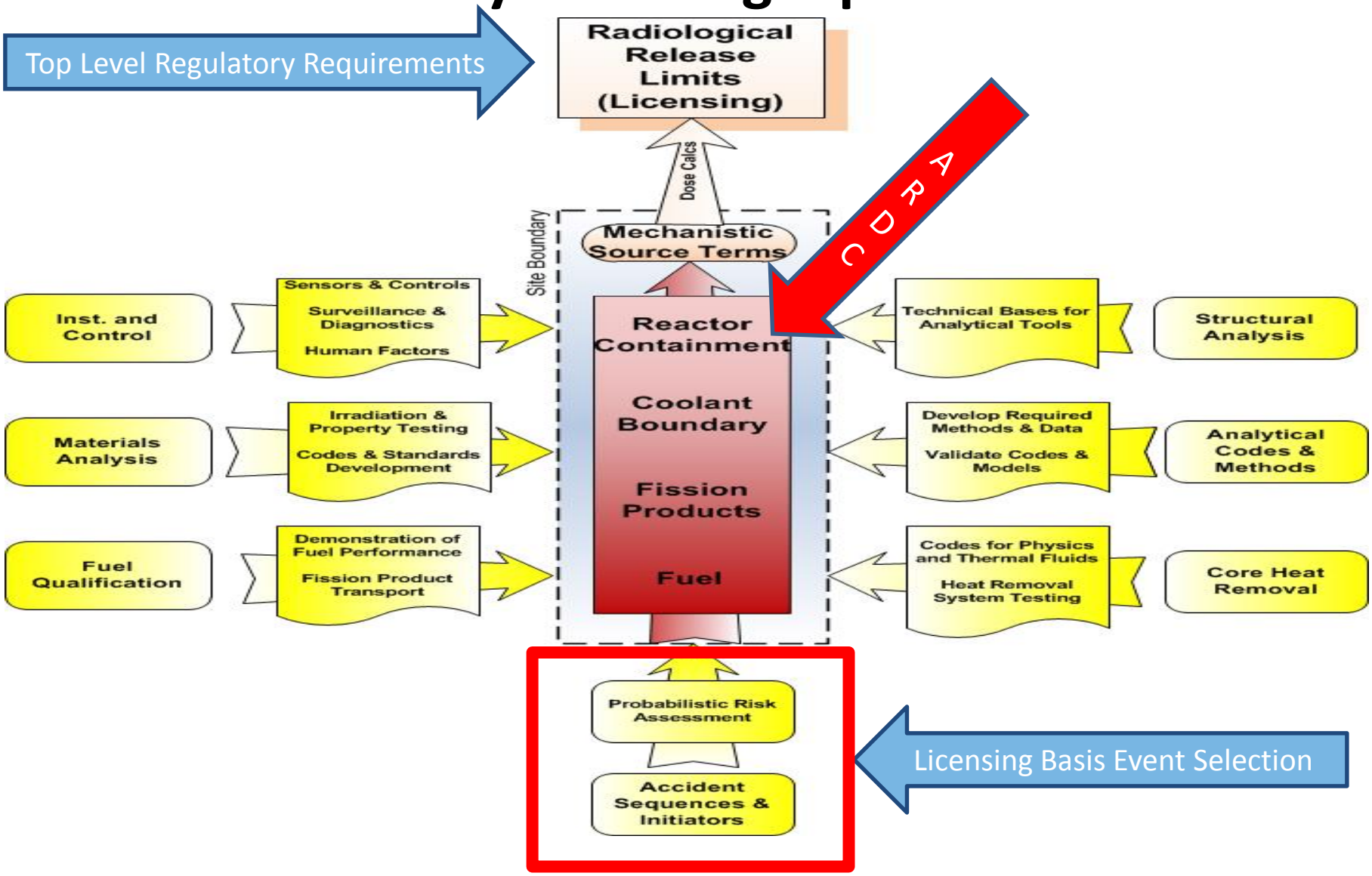
Key Licensing Inputs



Addressing LBE selection should be top priority because it is the basis for all other licensing inputs

The Key Consideration

- SRP Chapter 15.0 statement:

  *"If **the risk of an event** is defined as the product of **the event's frequency of occurrence and its consequences**, then the design of the plant should be such that all the AOOs and postulated accidents produce about the same level of risk (i.e., the risk is approximately constant across the spectrum of AOOs and postulated accidents). This is reflected in the **general design criteria (GDC), which generally prohibit relatively frequent events (AOOs) from resulting in serious consequences, but allow the relatively rare events (postulated accidents) to produce more severe consequences**."*
- Conclusion: To meet this requirement LBE Selection has to be RIPB
- Options: Ad hoc RIPB Approach vs. Systematic RIPB Process

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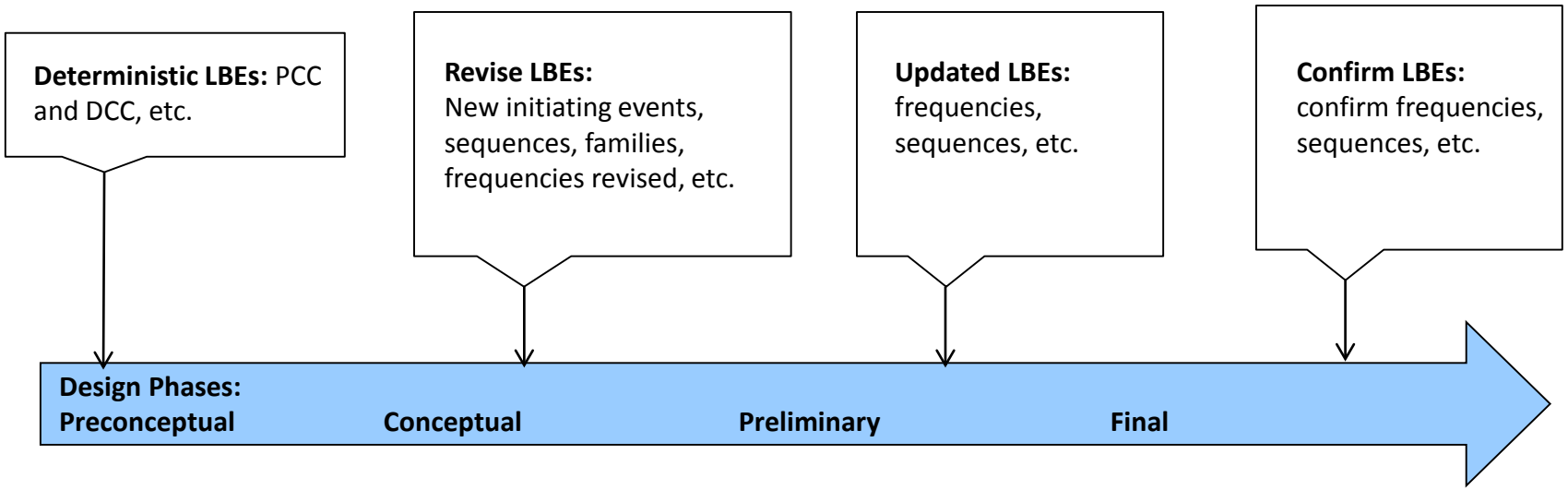
Comparison of Options for the LBE Selection Process

LBE Selection Options	Process	Tools used for identification and consequence analysis	Frequency estimate	Uncertainty Analysis	Technical Adequacy
Ad Hoc RIPB	Events are identified and analyzed based on Engineering Judgment; revised to reflect service experience	Ad hoc approach similar to FMEA; reproducible process to select LBEs for new reactors does not exist	Qualitative based engineering judgment	Not explicitly identified, addressed primarily using conservative assumptions based on engineering judgment.	No consensus standards as the LBE procedures do not exist; rests solely on regulatory review judgments.
Systematic RIPB	Incorporates approaches used in Ad hoc method in a systematic, reproducible PRA procedure.	FMEA, HAZOPs, MLD, PERT, PRA methods for systematic search for initiating events and defining accident sequences	Quantitative based on applicable service experience, engineering judgment and PRA data analysis methods	Explicitly identified and listed via structured PRA process,. Systematically analyzed and accounted for; defense-in-depth approach to capture uncertainties not well represented in PRA	ASME non-LWR PRA Standards, EPRI research, experience with HTGR and LMFR PRAs

Design Development Timeline

LBE evolution by design phase:



Inputs to design phases:

- Initial design concept
- Prior operating experience
- Expert insights

- Basic design
- Initial analyses (FMEA, scoping PRA, etc.)
- Prior operating experience
- Design rqmts.
- Expert reviews

- Updated design
- Detailed FMEAs, etc.
- Initial PRA results
- Expert reviews
- Regulator interaction

- Mature design
- Detailed FMEAs, etc.
- Complete PRA results
- Expert reviews
- Regulator feedback

Industry Comments on NRC's Non-LWR Near Term Implementation Action Plan

ACRS Meeting

March 9, 2017

Michael Tschiltz

NEI

Director of New Plant, SMR and Advanced Reactors

NRC's Non-LWR Vision and Strategy

NRC's non-LWR near-term Implementation Action Plan (plan) is an important step to enhance NRC's readiness for licensing advanced reactors.

- The plan improves the **transparency of NRC activities** in support of licensing Advanced Non-LWR technologies.
- The plan should be used in a way that results in a more efficient and effective licensing process (predictable schedule/cost = reduction of licensing risk)
- The IAP should be maintained as a "living plan" and not a snapshot in time
- NEI/Industry is ready to work closely with the staff in support of development of more detailed tasks and work plans that:
  - integrate activities to identify critical path; and
  - prioritize efforts necessary to best utilize available resources.

Prioritizing near-term activities

The plan contains more actions than can be completed with limited resources in the next 5 years.. Highlights the need for prioritization.

- **Strategy No. 3** – Develop guidance for a flexible non-LWR regulatory review within the bounds of existing regulations
  - Should be given highest priority
  - Informs the need for and priority of other activities (training, codes

- **Strategy No. 5** – Identify and resolve technology-inclusive policy issues that impact the regulatory reviews, siting, permitting and/or licensing of non-LWR NPPs
  - Identify technology-inclusive policy issues and/or any gaps in the existing regulatory framework early in the process (Policy issues typically take longer to resolve)
  - Develop technology or design-specific licensing project plans that identify information needed for to support staff findings

Conclusions

- Industry ready to support near-term plan activities.
- Strategies 3 and 5 are highest priorities.
- Staff should take advantage of the efforts of the utility-led Licensing Modernization Project to make the licensing process more risk-informed and performance based.

Comments on NRC Non-LWR Vision and Strategy Implementation Action Plans and Staged Licensing

Advisory Committee on Reactor Safeguards

Peter Hastings

09 Mar 2017

Staged Licensing

- Staged regulatory review should be further developed
- Conceptual Design Assessment
  - Can provide more structure and certainty in pre-application interactions
  - Development in FY2017
- Standard Design Approval
  - Developing guidelines to define “major portion”
  - Coordination with NRC staff pending shortly
- Licensing Program Plan (Regulatory Engagement Plan)
  - Important communication tool
  - Establish applicant-staff agreement on path forward
    - Pre-application options
    - Application type
    - Project management expectations

NUCLEAR INNOVATION ALLIANCE

Near-Term IAPs

- NIA strongly supports each strategy
- Strategy 3 guidance should complete within two years
  - Collaborate with industry on detailed contributing activities
  - Accelerate efforts to support near-term guidance
- Strategy 5 (policy issues) prioritized for near-term action
  - All work planned for FY2017
  - Coordination with industry
- Strategy 2 (computer codes) should be expanded
  - Enhance modeling and simulation for fuel qualification process
  - Should consider existing fuel information, e.g., within DOE complex
  - May require enhanced use of demonstration/prototype provisions

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Conclusions

- NIA applauds and supports NRC efforts
- NIA eager to work with staff
  - Continued development of strategic and near-term planning
  - Various aspects of staged licensing
- Mid- and long-term IAPs under review

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ACRS Full Committee Meeting

Advanced Reactor Design Criteria, Non-LWR Vision and Strategy, and Implementation Action Plans

March 9, 2017

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Outline

- Introduction
- Advanced Reactor Design Criteria
- Summary/Overview
  - Vision and Strategy
  - Implementation Action Plans

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Non-Light Water Reactor Design Criteria

Jan Mazza
Advanced Reactor and Policy Branch
March 9, 2017

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Overview

- DG-1330, "Guidance for Developing Principal Design Criteria for Non-Light Water Reactors," out for public comment February 3rd through April 4th 2017.
- ACRS Subcommittee meeting held February 22nd discussed several of the design criteria in-depth.
- Today's presentation will provide a brief summary of the select group of design criteria and significant comments made during the ACRS Subcommittee meeting.

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Reactor Design

Topic	Design Criteria	Summary of Adaptation from Current GDC	Comments from ACRS Subcommittee Meeting
Reactor Design	mHTGR-DC 10	Specified acceptable system radionuclide release design limits (SARRDLs) are used instead of specified acceptable fuel design limits (SAFDLs). The SARRDL concept allows for some small increase in circulating radionuclide inventory during an anticipated operational occurrence.	Provide more information on the definition of SARRDL and how it would be implemented. In addition, the staff should consider using specific acceptance criteria which correspond to TRISO fuel failure modes. The use of specific criteria would be more consistent with the current GDC 10 SAFDL approach. Also, include monitoring of plate-out activity in addition to circulating activity.

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Containment Design

Topic	Design Criteria	Summary of Adaptation from Current GDC	Comments from ACRS Subcommittee Meeting
Containment Design	ARDC 16	ARDC 16 is the same as the current GDC 16 which specifies an essentially "leaktight barrier." ARDC 16 also acknowledges that other non-LWR designs may use the SFR or mHTGR design criteria, however a policy decision would be needed if the mHTGR-DC is used.	Define "…for as long as postulated accident conditions require," e.g., containment floor leakage at TMI-2 was a concern well after the accident. Define containment performance requirement for containment function rather than leak tight, low leakage etc.
	SFR-DC 16	SFR-DC specifies a high strength low leakage pressure retaining structure surrounding the reactor and its primary cooling system.	Consider the possibility of common mode failure of multiple barriers (e.g., guard vessel sharing a foundation with the reactor vessel).
	mHTGR-DC 16	mHTGR-DC specifies a "functional containment" that does not have a pressure retaining structure. The TRISO fuel provides multiple barriers of protection.	Clarify that containment performance requirements will be dependent on LBEs which need to be defined.

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Electric Power

Topic	Design Criteria	Summary of Adaptation from Current GDC	Comments from ACRS Subcommittee Meeting
Electric Power	ARDC 17	The ARDC was modified to place emphasis on requiring reliability of power sources rather than prescribing how such reliability can be attained.	Consider the importance independence, diversity, and defense-in-depth for electric power systems (e.g., lack of an offsite power requirement). Clarify that "vital functions" include emergency lighting, radiation monitoring, communications, control room habitability, and post-accident monitoring.

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Reactivity Control

Topic	Design Criteria	Summary of Adaptation from Current GDC	Comments from ACRS Subcommittee Meeting
Reactivity Control	ARDC 26 and 27	ARDCs 26 and 27 were merged into one design criteria. The design criteria includes the functionality to provide 1) a means of shutting the reactor down during normal operations and anticipated operational occurrences 2) a means of shutting down and maintaining safe shutdown during design basis events 3) a system for holding the reactor subcritical under cold conditions.	The design criteria appears to address shutdown control vs. reactivity control. Consider renaming this design criteria. Controlling the rate of reactivity changes from planned normal power changes as currently described in GDC 26 should be addressed.

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Sodium Leakage Detection and Reaction Prevention and Mitigation

Topic	Design Criteria	Summary of Adaptation from Current GDC	Comments from ACRS Subcommittee Meeting
Sodium Leakage Detection and Reaction Prevention and Mitigation	SFR-DC 73	SFR-DC 73 discusses the need to detect sodium leakage and to limit the extent of reactions with air and concrete and to mitigate fires resulting from reactions.	Consider the possibility of failure of steel lined concrete SSCs due to heat up of concrete that results in steam forming between the steel and concrete, and subsequent failure of the steel liner.

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Sodium/Water Reaction Prevention/Mitigation

Topic	Design Criteria	Summary of Adaptation from Current GDC	Comments from ACRS Subcommittee Meeting
Sodium/Water Reaction Prevention/ Mitigation	SFR-DC 74	SFR-DC 74 discusses the need to provide means to avoid contact between sodium and water. This includes the steam/water energy conversion system.	Expand the design criteria to include sodium reactions with working fluids of energy conversion systems other than steam/water (e.g., carbon dioxide, nitrogen, etc.).

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Cover Gas Inventory Maintenance

Topic	Design Criteria	Summary of Adaptation from Current GDC	Comments from ACRS Subcommittee Meeting
Cover Gas Inventory Maintenance	SFR-DC 79	SFR-DC 79 discusses the need for a system to maintain the cover gas to ensure that primary coolant sodium design limits are not exceeded as a result of cover gas leakage.	Clarify whether this requirement also applies to the spent fuel pool. It was noted that in some SFR designs, the spent fuel is kept in the reactor vessel for one fuel cycle. Staff should consider how to address this in the design criteria.

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mHTGR Technology Specific Criteria

Topic	Design Criteria	Summary of Adaptation from Current GDC	Comments from ACRS Subcommittee Meeting
mHTGR Technology Specific Criteria	mHTGR-DC 70-72	These technology specific design criteria address attributes of mHTGR technology such as reactor vessel, reactor system, and reactor building structural integrity.	Clarify that the geometric integrity of the reactor vessel and reactor system must be maintained during postulated accidents.

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General Comments

General Comments
Include language that does not preclude the use of quantitative risk assessment for non-LWRs
Economy of words is not helpful for designers. Adding adjectives would be helpful (e.g., independent in ARDC 17, etc.)
Consider historical experience from past designs (e.g., FERMI, etc.)
Ongoing and future research may identify the need for additional design criteria
Security considerations for non-LWR designs will be important due to the nature of heat removal systems that rely on a structural geometry to be maintained.

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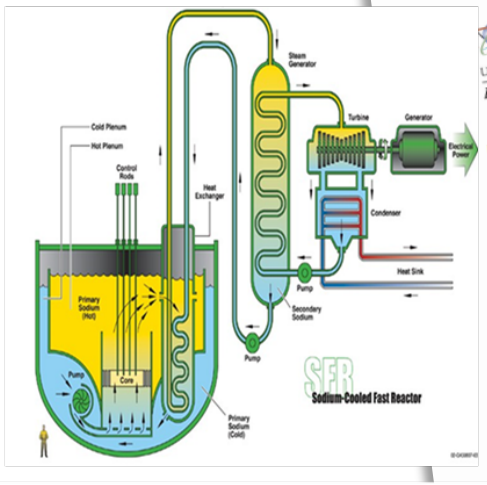
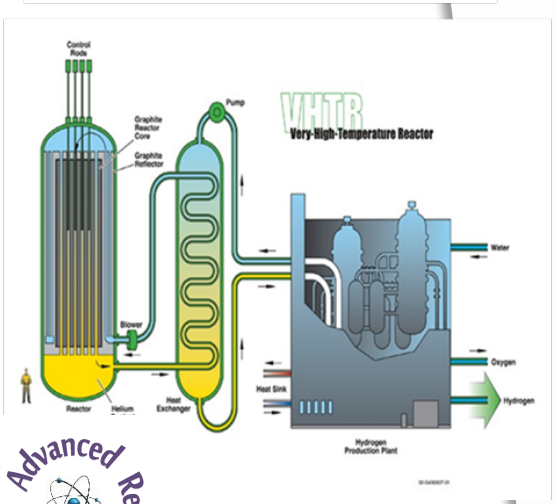
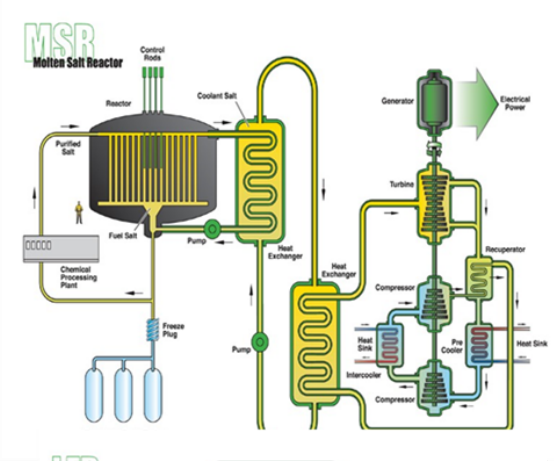
Non-LWR Vision and Strategy and Implementation Action Plans

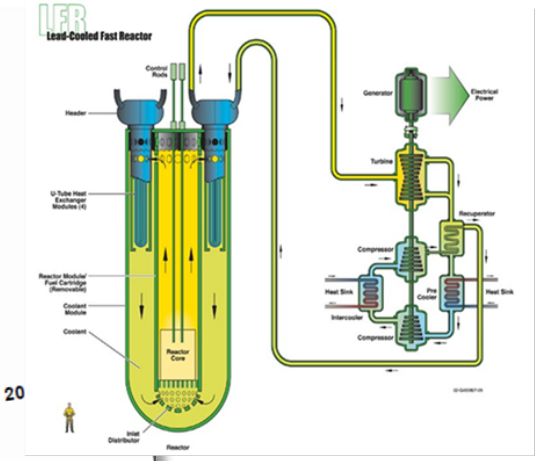
Amy Cubbage
Advanced Reactor and Policy Branch
March 9, 2017

Non-LWR Vision and Strategy

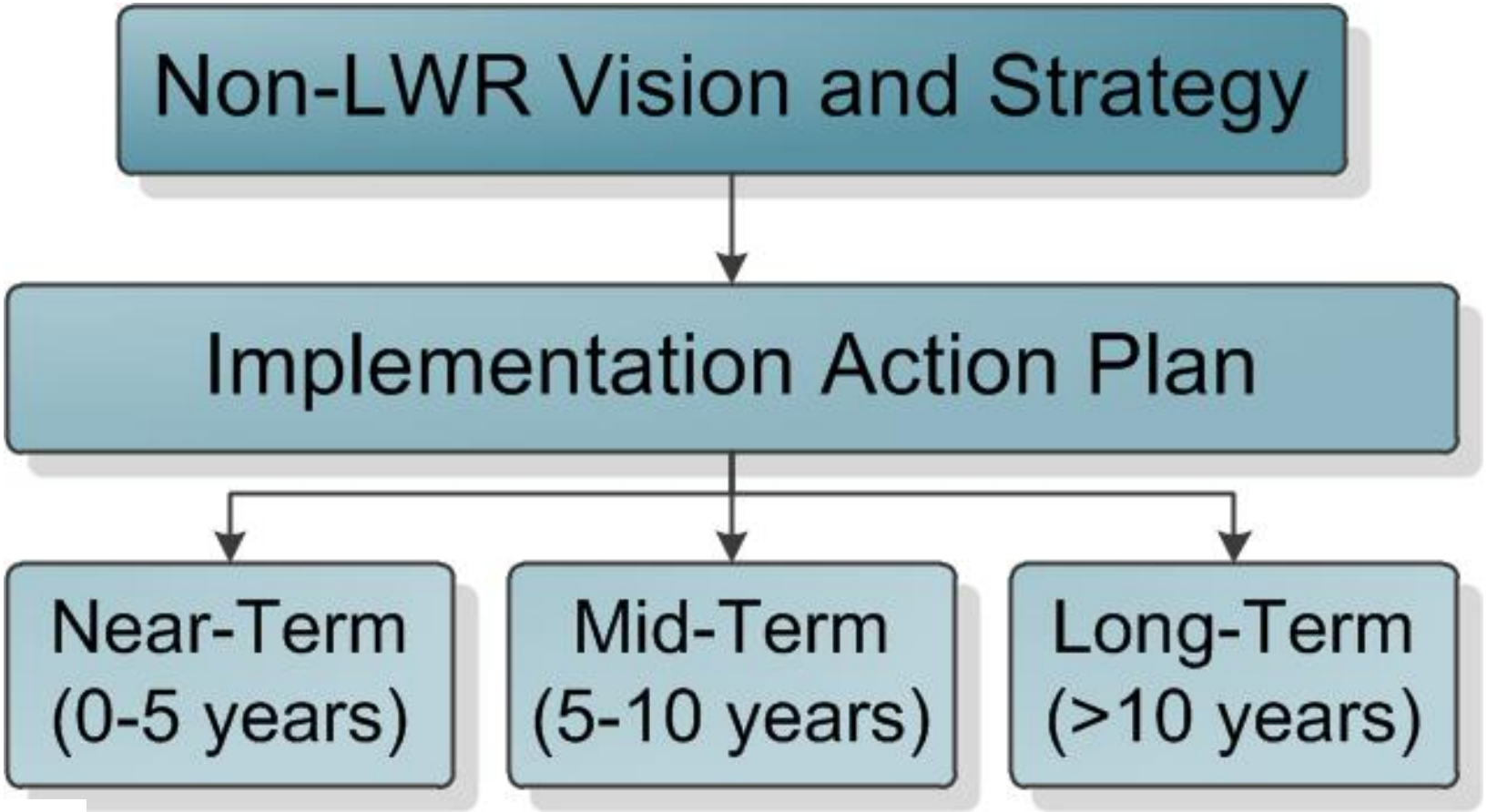




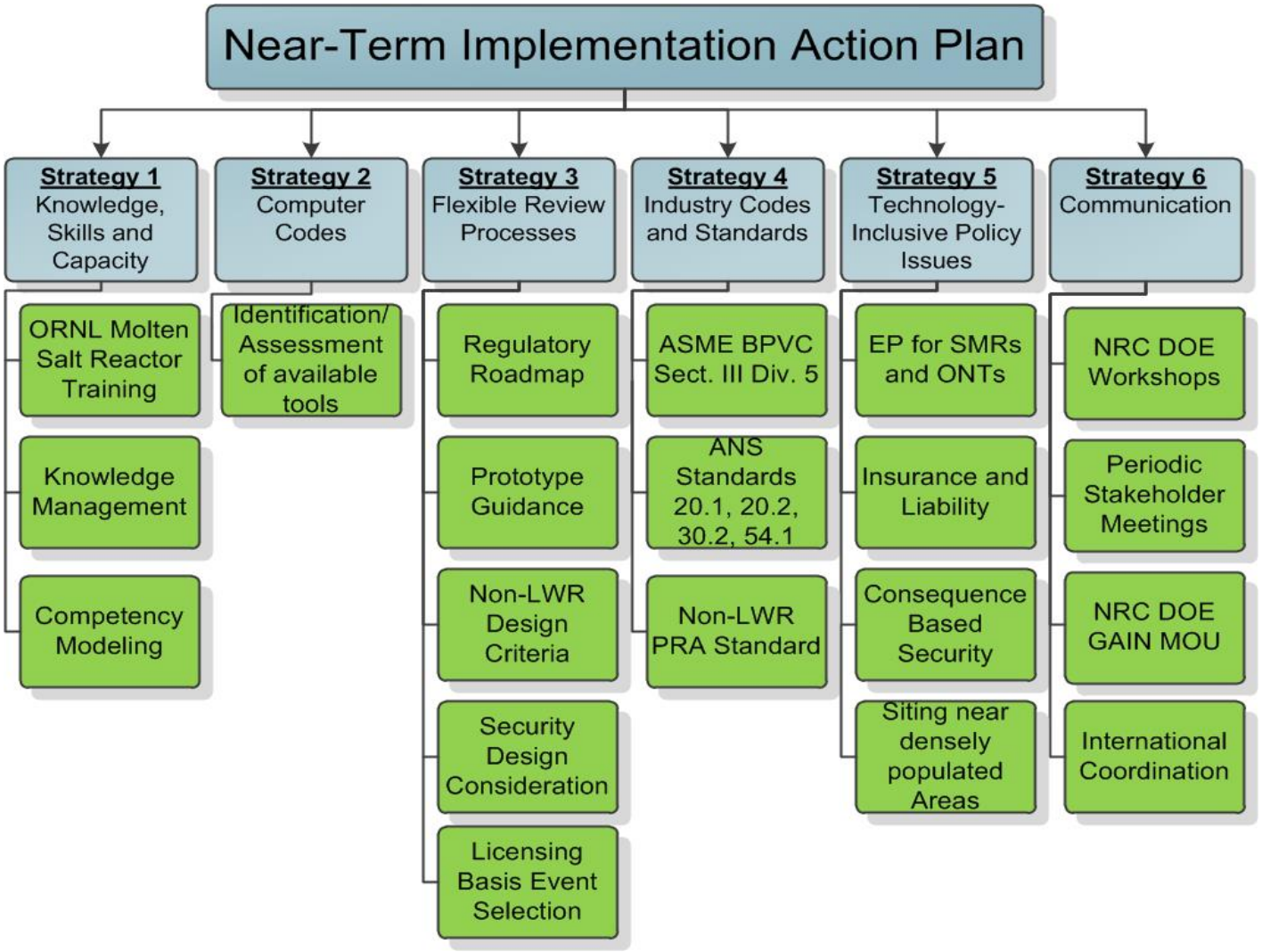




Implementation Action Plans (IAPs)



Examples of Ongoing Near-Term IAP Activities



Pre-Application Activities

- Oklo, Inc.
  - Pre-application meetings held on November 17, 2016 and December 14, 2016
- Terrestrial Energy
  - Plans to seek pre-application interactions prior to the 2019 timeframe for its Integral Molten Salt Reactor
- Core Review Team Approach
  - Supports efficient and effective pre-application interactions
- Additional pre-application reviews anticipated in the near-term

Pre-Application Activities

- Emphasis on developers preparing licensing project plans
- Quality assurance program among first submittals for NRC review and approval
- Technology readiness levels, research and development programs, analytical uncertainties, quality assurance, and other factors considered in feedback provided to developers

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Subcommittee Discussions

- Overall Approach
- Strategy 2 – Technical analysis, incluing acquiring/developing sufficient computer codes and tools to perform non-LWR regulatory reviews
- Strategy 3 – Flexible regulatory review process, including framework for establishing non-LWR licensing bases
- Strategy 5 – Identify and resolve policy issues

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