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UNITED STATES NUCLEAR REGULATORY COMMISSION'S
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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657TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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THURSDAY

OCTOBER 4, 2018

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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., Michael L. Corradini, Chairman, presiding.

COMMITTEE MEMBERS:

MICHAEL L. CORRADINI, Chairman
PETER RICCARDELLA, Vice Chairman
RONALD G. BALLINGER, Member
DENNIS C. BLEY, Member
CHARLES H. BROWN, JR. Member
MARGARET SZE-TAI Y. CHU, Member
VESNA B. DIMITRIJEVIC, Member
JOSE MARCH-LEUBA, Member

DANA A. POWERS, Member
HAROLD B. RAY, Member
JOY L. REMPE, Member
GORDON R. SKILLMAN, Member
MATTHEW SUNSERI, Member

DESIGNATED FEDERAL OFFICIAL:

DEREK WIDMAYER

*Present via telephone

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P R O C E E D I N G S

(8:28 a.m.)

CHAIRMAN CORRADINI: Okay, the meeting will now come to order. This is the first day of the 657th Meeting of the Advisory Committee on Reactor Safeguards.

In today's Meeting, the Committee will consider the following, draft rule on emergency preparedness for small modular reactors and other nuclear technologies, annual operating reactor experience, assessment of the quality of selected NRC research projects, and preparation of ACRS reports.

The ACRS was established by statute and is governed by the Federal Advisory Committee Act, or 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.

We hold Meetings to gathering information to support our deliberations. Interested parties who wish to provide comments can contact our Offices requesting time after the Federal Register notice describing the Meeting is published.

That said, we also set aside 10 minutes for extemporaneous comments from members of the public attending or listening to our Meetings. Written comments are also welcome. Today Mr. Derek Widmayer is the designated Federal official for the initial portion of the Meeting.

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

We're received no written comments or requests to make oral statements from members of the public regarding today's sessions. There will be a phone bridge line. To preclude interruption of the Meeting, the phone will be placed in a listen-only mode during the presentations and Committee discussions.

Also, today's Meeting is being webcast. A transcript of portions of the Meeting is being kept and it is requested that speakers use one of the microphones to identify themselves and speak with sufficient clarity and volume so they can be really heard.

I'll also remind everybody to please turn off your devices or mute them so we don't have buzzing, ringing, beeping during the Meeting. With that, our first topic will be talking about the draft rule on emergency preparedness for small modular reactors and Mike Scott will begin the session. Mr. Scott?

MR. SCOTT: Good morning, Mr. Chairman, thank you very much. Yes, my name is Mike Scott, I am the Director of the Division of Preparedness and response in the Office of Nuclear Security and Instant Response at the NRC.

I am here speaking on behalf of the Steering Committee for Emergency Preparedness for small modular reactors and other new technologies since Dr. Holahan, who would normally be sitting here is on travel.

So I'd like to take this opportunity to thank the ACRS Committee for allowing us the opportunity to discuss with you the emergency preparedness for small modular reactors and other new technologies, or EPSMR ONT, proposed rulemaking. It's a lot to say.

Seated at the table with me are Kenny Thomas from NSIR, Andrew Carrera, the rulemaking PM from the Office of Nuclear Material, Safety, and Safeguards, and Arlon Costa from the Office of New Reactors.

We have Working Group Members in management from various Offices here at the NRC who are also here this morning to support the presentation.

Key Staff Members include Steve Lynch from NRR, Ed Roach from NSIR, Howard Benowitz, and Marcia Carpentier from OGC, Michelle Hart from NRO, and Keith Compton from the Office of Research, all in attendance to assist in addressing questions the Committee might have.

As most of you are aware, on August 22nd, the Staff met with the ACRS Joint Subcommittee to discuss the draft proposed rule and proposed guidance. At the Meeting the Staff discussed the background and regulatory basis associated with this rulemaking, as well as the approaches the Staff has taken to the rulemaking.

Staff appreciates the comments and feedback that we have received from the Subcommittee regarding the proposed rulemaking.

The Staff has considered the Subcommittee's comments in preparing for today's Meeting, and the goal for today's Meeting primarily for us is to address the ACRS Subcommittee's comments.

We understand that it was the

Subcommittee's preference that we focus on these subjects and so that's primarily what you'll hear today. Of course, if there are additional questions that come up, we will of course answer those.

We will also provide an overview of the rule and the philosophy behind it. As previously presented in the Subcommittee Meeting, the Staff is proposing new EP requirements and implementing guidance to adopt a consequence-oriented, risk-informed, and performance-based approach to emergency planning, as well as one that is technology inclusive.

The proposed rule would provide all existing and future SMR and non-light water reactor licensees applicants and future utilization facility licensees that would be licensed after the effective date of the rule, an alternative to develop and to comply with a performance-based EP rule.

The proposed rule would be an alternative to the existing deterministic EP requirements that are in 10 CFR Part 50. Because it is optional, it is not a backfit and backfit considerations do not apply.

One of the aspects of the rule that is most transformational I'd like to highlight is the concept of making EPZ sizing proportional to the risk posed by the facility. The NRC has a long history of doing that in a more case-specific manner.

If you think back to the days of Fort Saint Vrain and Big Rock Point, those were examples of reactors that operate at power reactors that operated with a smaller EPC size than the 10 miles that is normally specified for large, light-water reactors and that is, in fact, the case for all of the existing fleet because those small reactors with lower risks are no longer in operation.

So that has been the case for a substantial period of time. We also do not require offsite Federally-mandated licensee-funded radiological emergency preparedness plans for research and test reactors.

So this is not new to us, the concept is not new, but the opportunity for an Applicant or licensee to demonstrate the appropriate EPZ size based on risk posed by credible accidents regardless of the technology involved is new.

So to take that to its full extent, there is the potential for a site boundary EPZ, that is to say for a facility that has a particularly low risk, to have the EPZ end at the site boundary such that there would be no offsite Federally-mandated EPZ.

So that is a transformational process for the NRC. The staff has developed an associated draft implementing guidance document, DG1350 for use by licensees, applicants, and the NRC Staff.

The draft proposed rule is on track to be submitted to the Commission in October of this year for a vote prior to issuance for public comment. Later in the presentation, Andy will provide you will further details regarding the rulemaking deliverables and scheduling.

I'd like to especially acknowledge and express my appreciation for the Working Group Members for all of the outstanding work that they have done associated with this rulemaking effort. It's been a substantial rule and we believe it's come out in a good place.

We look forward to an informative interaction with the ACRS today, and with that, I'll turn the presentation over to Kenny Thomas.

CHAIRMAN CORRADINI: Dennis, go ahead.

MEMBER BLEY: The words credible accident has come up many times in the discussion. We're more than 40 years since WASH1400. We speak of risk as consequences and likelihood. What does credible mean and why is it in here if this is --

MR. SCOTT: What does incredible mean?

MEMBER REMPE: Credible.

CHAIRMAN CORRADINI: I think, Dennis, you meant to say what does credible mean? Either one.

MEMBER BLEY: Our risk concept is based on credibility and consequences and credible seems to have no point unless you put the number to it and you want people never to think of anything out there. It's about risk-informing.

MR. THOMAS: Thank you, Dr. Bley. I'm Kenny Thomas and I will be leading the presentation this morning but I would like to call on a couple of our key Staff Members to be able to at least mention their analysis or what we have at the NRC that addresses credibles.

First up would be Michelle Hart from the Office of New Reactors. Michelle?

MS. HART: I'm Michelle Hart from the Office of New Reactors.

I work in the Radiation Protection and Accident Consequences Branch and, yes, the term credible in the regulation is intended to mean we're talking about if you look at a range of accidents but we don't want you to have to do anything that is very unlikely.

It's not intended to be just a design basis accident or something like that. We don't have a specific definition of credible in this document or in the regulation, nor do we have a definition of credible anywhere else that I'm aware of.

CHAIRMAN CORRADINI: So let me follow Dennis. So what I hear is that it gives the Staff wiggle room to determine what sequence, frequency is above the line or below the line.

MS. HART: Right, we're looking and this is something that as we review, looking at the specific design and looking at the PRA information and other information about the plant design, we can determine the universe of scenarios that should be included in this range of accidents.

And that's what credible is intended to imply.

CHAIRMAN CORRADINI: Dennis? Can you repeat that? The universe of what?

MS. HART: Accident scenarios. Universe of accident scenarios.

MEMBER REMPE: Well, I'll ask, no one has said the frequency word and cutoff frequency word at this time, and that's the question that's kind of being danced around here, right?

MR. SCOTT: That plays into what credible is.

MEMBER REMPE: It should, yes. That plus uncertainties, yes, it definitely should. But nobody wants to bite the bullet and say this is what the cut-off frequency should be.

MS. HART: This is Michelle Hart again. I think that's something to be determined based on specific analysis that we're looking at for the specific design.

We're not pre-defining what credible is based on a CDF or something like that, especially since some future reactor design, non-light-water reactor designs, or even non-light-water reactors, other types of facilities may not have things such as core damage.

So core damage frequency, it may be more related to a release frequency and so we don't know all these designs at this time and so we're not making a pre-decision. We'll look at the total amount of information about that plan to help make that decision.

CHAIRMAN CORRADINI: So, I'm going to pretend to be the company. So I'm coming in blind as to what's expected? I'm putting you on the spot but on the other hand, that's what I sense.

In other words, you could say go look at 0396 and supposedly, there's some sort of logic and methodology in 0396 to years ago and at least you ought to --

MS. HART: That will give you some idea of the information that you would have and certainly, and we can talk about this some more, there's an expectation in the regulation that you took out a probabilistic risk assessment that you describe in your final safety analysis report and described the results.

So, there's an expectation that you will have looked at the risk of your plant in the first place so you should have sufficient information to at least get started on this.

CHAIRMAN CORRADINI: Dennis is back. Dennis?

MEMBER BLEY: Yes, sir?

CHAIRMAN CORRADINI: Did you hear all of this or part of it?

MEMBER BLEY: I've heard part of it. I got knocked off the line for a little bit.

CHAIRMAN CORRADINI: Do you have a follow-up?

MEMBER BLEY: I'm still where I was at the beginning. The words incredible really have no business in anything that's risk-informed. If the kinds of answers are big enough, you want the likelihood very, very small.

If the consequences are low, you don't care so much. And undefined terms that we use when we just did deterministic looking are not --

MEMBER MARCH-LEUBA: Is it the understanding of the Staff that credible means frequency or adverse consequences? That's I think what Dennis is asking.

MS. HART: The Staff intends that for each design they will be able to say what kind of releases are coming from that plan and what are credible for their specific design, what are likely to happen for their design.

And so, yes, frequency can be used and is likely to be used because they will have PRAs to be able to define the likelihood of these events and the consequences.

So, yes, the intent is to use both aspects, the frequency and the consequence.

MEMBER BLEY: If I could jump in again, credible as you just said is the result of the PRA where you've looked at the whole range of consequences, rather than something going in, the way it's stated before that discussion sounds like there's a whole class you don't even think about.

You draw a line somehow and that one just doesn't fit the content.

MR. KAHLER: If I can, this is Bob Kahler, I'm Branch Chief with NSIR DPR overseeing the technical aspects of the rulemaking.

With regards to the EP rulemaking, the use of the term for credible accidents, where we are identifying, that is something that would be predetermined in order to be used, in order to be part of the risk-informing of the EPZ size and of the regulation.

So, this is something that we looked to the other Offices to be able to make that determination. As it goes through the design review process, that suite of accidents would be identified by the design.

And 0396 had the luxury of having those accidents already available to them from the current designs that they were looking at for the ten-mile EPZ.

We have that same approach that we're

utilizing here for the credible accidents that were identified through WASH 1400 and such, were part of the analysis done in 0396 as to what credible accidents would be utilized to determine the 10-mile EPZ size or to determine the EPZ size.

So, when you look at it, we are just saying that the term credible is something that we are utilizing within the EP rulemaking as the designs have already been approved and predetermined with that suite of accidents.

I just want to make sure we understand that the EP rulemaking piece of this is -- we're not defining the term credible within the EP rulemaking. It is something that is going to be provided for the designers and for those that will be determining and proposing EPZ sizes.

CHAIRMAN CORRADINI: So let me quote from 0396. There was a sentence in here that, to me, said it and it sounds to be novice, risk-informed. To state this is on Appendix 1, Page 10.

To restate this, there was about a one percent chance of emergency plans being activated in the U.S. beyond the recommended EPZs within the next few years or within the next time period. It seems to me in an uninitiated fashion that's close to a risk-informed criteria.

Now, I could add onto it that I want a 95 percent confidence relative to uncertainties but it seems to me some sort of guidance like this is going to have to be there whether it's in the rule or it's going to be in a reg guide connected to the rule.

Otherwise, the incoming industries are going to be -- we need a rock and you're going to tell them not that rock, go find me another rock. And I just don't find that to be an acceptable path forward. That's what I sense Dennis is asking.

MEMBER RAY: Maybe adding to what Michael just said, this discussion suggests that maybe there's room for some elaboration such as we just heard about the use of the word credible.

It's going to be determined in the following manner or something like that.

MEMBER REMPE: So, if we are done with that discussion, because I have a different question for you.

CHAIRMAN CORRADINI: Just a second.

MR. COMPTON: This is Keith Compton from the Office of Resources.

Just to get back to your point, I'm familiar with that statement about the likelihood and

I think one of the key things that NUREG 0396 did, and it's all through the document, is they were saying that you should have considered not simply of design basis accidents but beyond design basis accidents.

And what we are trying to do is keep that philosophy and that's true there, that in the methodology credible is not limited to design basis documents. It would include your consideration beyond design basis.

What NUREG 0396 did you is that for beyond design basis accidents, it included the consideration of their frequency. It did it in a certain way that used the frequencies and the consequences from WASH 1400. So we're keeping that idea.

The question of credible is something that, as I think Michelle just pointed to that, is another layer. Is there something that is simply so either low frequency or for which you make an argument that it just simply is not credible?

That is something that would have to be assessed by the Staff. It would be very challenging for me right now to give a single prescriptive guidance that would cover all possible circumstances. So right now we're simply putting this information out.

MEMBER RAY: But I don't think we would suggest that kind of detail.

Just some elaboration that indicates because this goes out to a community of people that aren't invested in this the way we all are, indicating that what defines the credible or what is the credible accident will be determined in whatever manner you say. A sentence or two would be ample in my judgment.

MEMBER BLEY: This is Dennis again. The way it was just phrased is pretty good.

I have a strong bias against language because of the way it's been used in the past but if you anchor it to those concepts and that is really coming from the risk analysis and it goes beyond design basis, that would certainly help.

Right now, it's just there is something for which everyone has their own definition.

CHAIRMAN CORRADINI: I'm sorry, Joy, go ahead. I guess now we're on a different subject.

MEMBER REMPE: I would like to explore a little bit more about what happened with Fort Saint Vrain. It started off being authorized or licensed by the Atomic Energy Commission.

When did 0396 come out? When was the planning zone selected? Was NRC really the organization that authorized the EPZ because of timing when 0396 came out?

MR. SCOTT: That's even before my time, I hate to admit it.

MEMBER REMPE: Yes, I was in high school back then.

MR. SCOTT: Do we have somebody here who can speak to the details of the way Fort Saint Vrain transpired? Bob, surely you weren't around for that?

MR. THOMAS: Dr. Rempe, again, Fort Saint Vrain, we were in the midst of the post-TMI rulemaking.

We had published the proposed rule in 1980 and there were three plants that applied during the proposed rule phase and said, hey, could we get reconsidered instead implementing a ten-mile emergency planning zone around our plant, specifically Fort Saint Vrain, Big Rock Point, and La Crosse?

They came in during the proposed rule phase and said we propose a five-mile plume exposure pathway emergency planning zone and a 30-mile ingestion pathway emergency planning zone around our plants.

They provided that technical justification, the Staff reviewed that technical justification and agreed to impose a 5-mile, 30-mile emergency planning zone around those three facilities.

And that all happened prior to the issuance of the 1980 rule. So if you were going to look back at the rule in Section 50.33, you'll see that specific exclusion is in 50.33G, Paragraph --

MEMBER REMPE: Out of curiosity, what kind of justification? Did you go to that level of detail to figure out what they provided that gave you that confidence? Did they give you some risk assessment?

MR. THOMAS: I do have those documents, I did not bring those with me today but they are available. Mr. Ed Roach is approaching the microphone, I can turn it over to him.

MR. ROACH: Hi, I'm Ed Roach, I work in NSIR. I do have the Big Rock Point document that we took off with the microfiche, and basically, they did an analysis of the releases and where they would exceed the EPA tags at that point.

And that's how they came in and requested via the NRC to set the EPZ at five miles for Saint Vrain and Lacrosse, and also provide a document like that.

And that was prior to the final FRN being issued to the final rule for the EP in 1980. It all reflected in that final rule but it happened as a result of the first TMI actions.

MEMBER REMPE: So when you said they provided the releases, for what type of events beyond design basis events?

MR. ROACH: An example, I can put this to the Committee if you want but it's in our records, what the fission yield for activity and then the analysis with meteorology for that site, why they justified setting it at 55.

MEMBER REMPE: I'm just curious if they went beyond it to the beyond design basis events is what I'm trying to get to.

MEMBER BLEY: This is Dennis, may I sneak in?

MEMBER REMPE: Sure.

MEMBER BLEY: I kind of hate to admit it but I was around then.

MEMBER BROWN: You're not the only one.

MEMBER BLEY: Two things happened at the same time. WASH 1400 in about 1973 then got revised a little bit. The shift from AEC to NRC happened in about 1974, as I remember 1975.

The reactor safety study came out as WASH 1400 under the AEC and later was published under a

NUREG number under the NRC. But the Agency didn't really change on the regulatory side.

What the process did was put up the promotional side in the IRDA and later DOE. So the regulatory side is pretty consistent. I think we'd be smart to just consider AEC through NRC as the one Agency that changed names on the regulatory side.

MEMBER BALLINGER: By the way, 50.33G does not say 5 and 30. It says the size of EPZ may also determine on a case-by-case basis for gas pollutant reactors and for reactors with an authorized power level of less than 250 megawatts, thermo. So it didn't say, it didn't give a number.

MR. THOMAS: No, it didn't and it was that case-by-case analysis that this rule really does intend to say for small modular reactors, less than 1000 megawatts thermal, and other new technologies based on the design we're going to take a look at that on a case-by-case basis.

MEMBER BALLINGER: So this is a little bit ambiguous if you talk about NuScale because one NuScale module is X, Y modules is Y.

MR. THOMAS: Thermal?

MEMBER BALLINGER: Yes, sir.

MR. COSTA: This is Arlon Costa but the

definition that we have in the rule, we also define small modular reactor that's anything less than 1000 megawatts thermal and so NuScale falls into that category.

MR. SCOTT: I believe what he's referring to is you get a 12-pack of NuScales, more than 1. That's the distinction.

CHAIRMAN CORRADINI: I think we can go ahead now. We've excavated this as far as we can so far.

MR. THOMAS: Sounds good.

CHAIRMAN CORRADINI: On your first line.

MR. THOMAS: We are still on track believe it or not. We can finish this.

MEMBER BALLINGER: Do you want any morphine for the root canal?

MR. THOMAS: No, I've got plenty of water. So, anyway, thank you again for these great comments that really set the stage for this presentation, a lively discussion and your comments.

I took notes through this so we'll continue to do that. In this presentation we will discuss the proposed rule and the thinking that went into this rule. So Andy, if I can get the next slide, please.

Okay, the proposed rule would be technology-inclusive.

It would provide an option to existing small modular reactors or SMRs, we've been saying this morning, and non-light-water reactor Applicants as well as all future small modular reactor and other new technology facilities licensed after the effective date of the rule.

The Staff was tasked to develop a rule that is technology-inclusive, which means that it will apply to a wide variety of designs, most of which the Staff has yet to see. The Staff does not have, as we pointed out already, or need the information about the source terms in order to develop the emergency preparedness rule.

Source term information is developed and reviewed under other processes. Therefore, the requirements for developing the various source terms and their other uses are not addressed by this rule.

CHAIRMAN CORRADINI: So let's stop there for a minute. What are the other processes?

MR. THOMAS: That's a great question. Andy, can we go to the last slide? We added a slide.

MR. CARRERA: This slide was developed really late last night. Dr. Corradini developed some of the responses in answer and the Staff developed these slides and it's included in the back of the last slide of the package.

And it really speaks about the Accident Source Terms. Unfortunately, it was late so it was not included.

CHAIRMAN CORRADINI: But where I'm going with this is this is just one Member speaking but the fact that I have one paragraph in Appendix A and one sentence in the rule strikes me as a bit on the minimal side, where one needs to go with this because it leaves it wide open.

And I connect it back to Page 10 of Appendix 1 of 0396 is that the reason I picked that sentence is they then connected, as I think Ken noted, to a set of both design basis accidents and severe accident release source terms and by that combination determined what they thought was the proposed 10-mile.

So I'm still back to the same thing that it's leaving the reader of the rule very little guidance at this early stage. And it strikes me as not very helpful if you're really trying to help the future industry.

MR. THOMAS: Thank you, Dr. Corradini. Again, Michelle Hart is at the microphone.

MS. HART: So I understand what you're saying about the guidance doesn't say specifically look at DBAs and look at severe accidents. Is that what you're comment really is?

CHAIRMAN CORRADINI: At minimum, I think that's kind of really where Harold was suggesting at a minimum you want to provide some sort of discussion because the sense of it is that's what happened back 40 years ago back in the '78 NUREG.

MS. HART: and that is our intent. So there are requirements that they've develop the design basis accidents to look at the siting and safety analysis, look at control room compatibilities. They're already doing that so that would be something that's there. And of course, those have a defined -- and I'm talking purely about reactors here and I'm talking about light water reactors especially, we do have guidance on how to do that assessment. And so it's something that they're already aware of how to do. For severe accidents as I had mentioned earlier, there is a requirement for reactors to provide probabilistic risk assessment for their designs, and so the development of the source terms for that, they need that to look at the large release frequency that they are required to look at the risk of the plant, to look at the risk characteristics. So you use those same source terms to develop those source terms, those releases to the environment, you can use the PRA standards. And there's one in development for the non-light-water reactors as well. And so we're relying on the fact that these other assessments are already required to license a facility and that you would have this information. And if I understand your comment, it's that it's not clear in our guidance that's what we're relying on. There's other processes --

CHAIRMAN CORRADINI: I think it's so brief as to the well-informed would probably know where to go. You have a spectrum of individual companies that think they're going to proceed with various designs. I'm not sure all of them are all well-informed.

MS. HART: Right, and this discussion is very reactor-focused and so this may not be as applicable to other facilities as well.

CHAIRMAN CORRADINI: I've made my point. Thank you.

MS. HART: Does that answer your concerns?

CHAIRMAN CORRADINI: Yes, thank you very much.

MR. THOMAS: We've been using the term

other new technologies in this presentation as well as in some of the associated documents to refer to non-light water reactors in medical radioisotope facilities. However, in the rule we don't refer to other new technologies. Rather, we use and define in the regulations non-light water reactors and non-power- production utilization facilities. In the context of this proposed rule, medical radioisotope facilities to be licensed under 10 CFR Part 50 but also be included within the use of non-power-production or utilization facilities. This rule proposes to apply the Commission's expectation that advanced reactors would provide enhanced margin of safety and/or use simplified inherent passive or other innovative means to accomplish their safety and security functions.

Next slide, please. May the provisions of this proposed rule and guidance would provide a new performance-based emergency preparedness framework, which is an alternative to the current regulations. The framework contains requirements for demonstrating effective response and drills and exercises for emergency and accident conditions, a hazard analysis of any NRC license or non-licensed facility contiguous to a small modular reactor or other new technology facility to identify hazards that could adversely impact the implementation of the emergency plans. A scalable approach for determining the size of the plume exposure pathway emergency planning zone, referred to as an EPZ, and a requirement for licensees to describe ingestion response planning in the facilities emergency plan, including the capabilities and resources available to protect against contaminated food and water from entering the ingestion pathway. These requirements would apply to those small modular reactor and other new technology facilities that elect to use the rule in Section 50.160.

Next slide, please. During the Subcommittee Meeting, the Staff received several comments concerning source terms. The typical source terms for credible accidents for each facilities will be evaluated in conjunction with the remainder of the review for the specific licensing application for the facility. The source terms will vary by design and each location will have a meteorology that will be a factor in the consequence analysis. Therefore, the consequences from an accident will depend on the design and specific location for the facility. To avoid confusion with the purpose of this rule, the

Staff made no changes to the rule or other document to address source term.

MR. KAHLER: If I can, Kenny, Bob Kahler again from NRC DPR, we've heard your concern and your comment and we'll give the due consideration for the guidance document on the elaboration on source term usage and how it is related to the EP rule.

MR. THOMAS: During the Subcommittee Meeting, the Staff received several comments concerning the technical reasons for the selection of 1000 megawatts thermal as the upper bound for the reactor power for light water, small modular reactors. The Staff did not perform an analysis as to whether there exists a characteristic of 1000 megawatts thermal about which reactor phenomena occur. The Staff selected the number based on the existing use by several key stakeholders such as the Department of Energy, facility designers, the international community, and even the NRC and the fee rule in parts 170 and 171 of Title 10 of the Code of Federal Regulations.

CHAIRMAN CORRADINI: So, can I restate what you just said?

MR. THOMAS: Yes, sir.

MR. SCOTT: So there is no technical

analysis that limits the rule? It's more by mythology and others?

MR. THOMAS: I don't think we'd say it was mythology. Use that to extract the comment from you but what I didn't hear is a technical analysis that says 1000 is a breakpoint.

CHAIRMAN CORRADINI: And as a matter of fact, you heard just the opposite. It is not a technical analysis. The decision was made based on, for example, assumptions as to the level of interest among the current large light-water reactor fleet in this rule and in this process. One of the things that we're going to propose to the Commission that we do is ask the question in the draft rule as to whether there's a view on this matter.

MEMBER MARCH-LEUBA: Yes, but I don't think this applies as much to the existing reactor. Nobody is going to go to the effort of read through the EPZ, they already have one. It's more if I want to build an ABWR or AP1000, why doesn't it apply to me?

MR. SCOTT: Again, it comes back to a decision and an assumption about the level of interest. So if we get a comment that comes in from potential interested party in that indicates the assumption was made was not a good one, they will revisit it.

MEMBER MARCH-LEUBA: Okay, let's let Kenny say what he wants to say.

MR. THOMAS: Thank you, sir. Additionally, in issues related to the selection of 1000 megawatts thermal, the NRC did receive a comment on the draft regulatory basis in 2017 that recommended the NRC expand the scope of the rule to include large light water reactors. Large light water reactors were not included by the NRC in the scope of this proposed rule because an emergency preparedness licensing framework already exists for these reactors and licensees for those plants have not presented a clear interest in changing that framework. Nonetheless, in light of the public comment on the draft regulatory basis and although this proposed rule is written for small modular reactors and other new technologies, the Staff has included a question for public input in the specific request for comment section of the Federal Register notice. The present-end stakeholders whether the NRC should consider a performance-based consequence-oriented approach to emergency preparedness for large light water reactor sites in fuel cycle facilities and currently operating non-power production or utilization facilities.

MEMBER MARCH-LEUBA: And that included future light power reactor sites? It's always existing ones unless there is something unusual, then I wouldn't go to the effort of doing it.

MR. THOMAS: That question would go to future large light water reactors.

MEMBER MARCH-LEUBA: Did you see any technical reason why it wouldn't apply?

MR. THOMAS: Did I see any technical reasons why it would not apply?

MEMBER MARCH-LEUBA: To a 3000 megawatt thermal reactor.

MR. THOMAS: I'm an AP guy. I can turn that over to the consequence analysis and the other folks and ask them for their technical opinion.

MEMBER MARCH-LEUBA: If the consequences are too large, then they won't be able to have a --

MR. SCOTT: I'm going to give you a management opinion. If we believe that we should have a risk-informed process then we should apply the risk-informed process and see where it comes out.

But that does pose potential that you could have either 10 miles or a different number for large light water reactors.

MEMBER MARCH-LEUBA: 25 miles if you analyze this properly. Maybe we made a mistake. Most likely it will be only five but it could while they're away.

MR. SCOTT: Again, since we are focused on being risk-informed and performance-based, then you can take that to its logical conclusion.

MEMBER MARCH-LEUBA: My comment is it looked like an arbitrary point.

MR. SCOTT: It is not based on technical criteria and I would say it's a little more than --

MEMBER BROWN: I have an information question. Where are the existing fleet's power reactors that are 1000 megawatts or less?

Some of the early plants that were developed, Shipping Port I thought was a much smaller reactor in the early days so they're all over 1000 megawatts.

MR. SCOTT: Thermal.

MR. THOMAS: During the Subcommittee Meeting, the Staff received several comments concerning the hazard analysis updating requirements. An update to the hazard analysis is already part of the rule.

The requirement for licensees to update

the hazard analysis is part of the requirements in Section 50.54 Q2 where the licensee must follow and maintain the effectiveness of its emergency plan.

Based on the requirements within 50.54 Q2, the Staff did not add any additional requirement to the hazard analysis itself to be updated on any set periodicity.

Next slide, please. During the Subcommittee Meeting, the Staff received several comments concerning the selection of 96 hours for a dose criterion. The use of 96 hours is part of the Environmental Protection Agency's protective action guide manual.

Specifically in Section 2.2.2, the 2017 protection action guide manual, it states the first 96 hours, specifically on Page 16.

Where dose projections are at levels less than one rem, ten millisieverts, over the first four days, evacuation is not recommended due to the associated risk of moving large numbers of people.

The decision-makers may consider implementing sheltering in place when projected doses are below one rem, ten millisieverts over the first four days.

MEMBER REMPE: So I think I was the one

who brought this up. I can recall years ago that 10 CFR 100 was based on the first two hours and the gas reactor folks said, oh, this is good news because we don't have stuff come out until later and you changed it to the worst two hours.

NUREG 0396 is based on a bunch of releases from light water reactors and so my question was, well, you might have some sort of a reactor where they might have circulating release early and then it takes a long time to heat up and it might be 99 hours before you get the bad release.

And I just was curious why are you sticking with the 96 hours?

MR. THOMAS: Well, the first part is the Environmental Protection Agency's protective action guides specifically calls out the 96 hours. But also in practice, the 96 hours is also looked at when at the facility they start doing dose projections.

During the response, the facility performs dose projections that forecast potential doses over the next four days or 96 hours for a four-day integrated dose to determine the emergency classification levels and any protective action recommendations.

This ongoing assessment during the

response looks forward 96 hours each time that dose assessment is conducted to determine whether protective action recommendations or an increase in the emergency classification level is warranted.

MEMBER REMPE: So what I think you're telling me is that it's because they continuously look 96 hours ahead so it's not just the first 96 hours. Is that what you're saying and what you're reading there?

MR. THOMAS: The 96 hours that we used were specifically in the rule where we're looking at the first 96 hours because that's tied to the Environmental Protection Agency's protective action guide.

MEMBER REMPE: So it's based on LWR evaluations?

MR. THOMAS: Yes, ma'am.

CHAIRMAN CORRADINI: Did you have more to say?

MR. THOMAS: No, sir.

MR. KAHLER: Again, Bob Kahler from NSIR DPR Branch Chief. It's not based upon large light water, it's based upon the 1 rem of 96 hours for determination of immediate protective actions for public health and safety.

So, what we're looking at is setting the EPZ size based upon what immediate protective actions need to be taken possibly within the first 96 hours to set that EPZ size for the implementation of the EPA PAGs.

So, when Kenny is talking about the dose projections that would go out from the beginning of the accident for the first 96 hours.

And if that is what EPA says you need to take immediate protective actions that exceed one rem, then we need to establish an easy size to accommodate how far out those projections would take that.

So that would be setting the EPZ size. But that's how that 96 hours comes in play with the determination of the EPZ size.

CHAIRMAN CORRADINI: But I think what Dr. Rempe is getting at, though, is depending on technology, you may have to reevaluate that going forward and that's why I'm still trying to get a clear picture from the NRC standpoint that is still going to be looked at beyond the first order.

And I think that's what her question --

MR. KAHLER: That is still a requirement of the regulation, is to continually do the dose projections. Even if you do not have an EPZ size but you have them on the site boundary.

You're still going to have to continually assess that and if at any time during that time period you would believe then that the offsites would be able to implement some sort of offsite protective action without the need to have the formal offsite radiological emergency preparedness program in place because that 96 hours would give you that leeway for them to take that protective action.

MEMBER REMPE: So this helps a lot. It would be nice if it was somewhere in the documentation. I didn't see it there but maybe I've missed it.

MR. KAHLER: To further clarify using of the 96 hours, thank you and we're going to watch for that comment.

MEMBER BROWN: Could I ask a question before you flip? You talked about the multiple modular considerations and you talked about your regulatory position, and that's the hazard analysis of nearby adjacent or contiguous facilities.

And it just says your analysis should identify the specific hazards proposed by multimodular nuclear units or multimodular units. I didn't see any criteria by which you might expect them to evaluate those.

And I'm just thinking about the NuScale situation where you've got 12 crammed into a building but there's no guidance put forth at all in terms of how you should assess the relevant power levels and how they should be addressed for the emergency planning zone considerations.

It just says look at it and identify but where's your breakpoint? Do you have any? If you look at the specific example which we're all well aware of, that's a pretty big, large, power unit when you combine them all together.

And that's different from having 10 units on a site spread around half a mile or a mile separating them all.

I'm just taking some type of other example where you could have a big site with multiple regular light water reactors and there's just no guidance, no identification of anything in terms of how they should just be performance analysis and tell us what you've got, and they'll figure out whether we accept it or not, I guess.

MR. THOMAS: You're right, there is very little guidance, it's not a rule. You're right, there is very little guidance in that except for what we had in the Regulatory Position Number 8. The reason for that is it's technology-inclusive.

We don't know which technologies would be brought to us, which designs would be brought to us, or how these would actually be sited.

MEMBER BROWN: Why does that matter? Damage to a plant or an accident in a plant creates a hazard situation where you need an EPZ.

Why does that matter relative to the fact that the criteria should be able to be assessed based on regardless of the technology?

Radiation is high levels or particulates or spread of contamination is a function of contamination and not necessarily what produces it.

MR. THOMAS: Yes, sir, what we were looking at was the potential external hazards unless the facility itself. That's why we looked at non-NRC license.

For example, military installations, transportations, so it's more focused on the licensee or the Applicant should be aware of where they're putting this.

MEMBER BROWN: You're talking about contiguous facilities as opposed to the facility? Isn't that somewhat short-sighted?

MR. THOMAS: Well, we also talk about the internal multi-modular considerations specifically.

MEMBER BROWN: But the only words say multi-modular. There's still no criteria.

CHAIRMAN CORRADINI: There's no criteria on the source term either.

MEMBER BROWN: I didn't mention that earlier. I was going to.

CHAIRMAN CORRADINI: Again, I'm going to break in.

I do think there are current plants that have shared ultimate heat sinks that would have to then -- that are being considered or should be considered from a probabilistic standpoint just as we would have hear in a shared open heat sink.

MEMBER BROWN: I understand that. It's an interesting question the way this is done. The differentiation between other nuclear technologies as opposed to light water reactors, et cetera, I think it produces a problem accident-wise and it doesn't matter what the technology is.

It's a problem. There are to be criteria. You made a statement earlier and I can't remember which of you all made it but this performance-based risk-informed, the magic words that we're using now, could result in no EPZ at all.

I didn't say anything at the time, it just took me back and that from a public health standpoint, how can you not have any EPZ at all established other than there's a boundary going around the plant that's got a fence around it and you can't get bad guys to get in?

That's a different issue. From an accident standpoint or a criteria standpoint, I have a hard time coming across no EPZ at all and that's the way I would have read this to see that you could end up with -- and you made that statement.

MR. SCOTT: I made the statement so allow me to clarify.

MEMBER BROWN: You're all part of the family.

MR. SCOTT: But let me clarify it. So I didn't intend to say no --

MEMBER BROWN: But that's what you could get out of this.

MR. SCOTT: What you can get, certainly, there will always be an onsite radiological emergency preparedness program.

MEMBER BROWN: That's different, that's not what this is, though.

MR. SCOTT: Right, so the delta there and the concept of the site boundary EPZ is that the hazard is low enough that an offsite formal Federally-mandated, licensee-funded emergency preparedness program, focus radiological emergency preparedness program would not apply.

That hazard would be in the range of other hazards that the community needs to contend with and that would be covered by the Federal all hazards emergency response program.

And state and local all have those emergency response programs so that's not the same thing as say no emergency planning and saying no full up Federally-mandated offsite program would be required because the hazard wouldn't suggest that it's necessary.

MEMBER BROWN: I have a hard time walking that one past, that's my own personal opinion. Thank you.

MEMBER SKILLMAN: I'd like to ask a question, please. To the concern Charlie Brown raised about contiguous facilities, it appears to me that you've addressed this very thoroughly in your draft guide 1350.

And as long as what you put in 1350 is

obeyed when this is finally -- then I think what Charlie is pointing to has been thoroughly and fairly taken care of.

The second comment, in this last discussion as Charlie says, a logical extension of this discussion is that the facility and the technology is such that there really isn't any release, there can't be any release. That could be one conclusion.

I'm a qualified and experienced Emergency Director and Emergency Support Director. I think in terms of an unusual event, alert side area and general.

And for me, general has always been that point when you make the notifications, your 96-hour clock begins or whatever the clocks are, and then you stay with the scenario and you stay with the event until you have to adjust what you've communicated in terms of key hold or shelf room place or evacuate.

That's the moving target based on what the radiological events offer that aren't naturally occurring.

Here's my question. To Charlie's point, do you envision a facility with other technologies where you have no general emergency?

MR. KAHLER: If I can, sir? Bob Kahler, Branch Chief for NSIR DPR. To go back to your terms of UE alert site area and GE, the definitions of those classifications are based upon the release and the magnitude of the release, and where that release is occurring and the type of response that is needed.

MEMBER SKILLMAN: That's why I'm asking the question. I'm well aware of that.

MR. KAHLER: So I would envision that if you have an EPZ and it's very plausible to have an emergency preparedness zone of where that one rem exceeds 96 hours be contained within the site boundary but there is no credible accident, if we can go back to that, I'm sorry, that would provide for that one rem within 96 hours beyond the site boundary.

That would then trigger the difference between the site area emergency and the general emergency. Site area emergency would require planning immediate protective actions for those within the site boundary and that is a requirement of the regulation to protect those people.

Even members of the public would be contained within that boundary but it would be the licensees emergency plan that would provide for their safety.

If it extends beyond the site boundary, that is when the offsite formal rep program is needed in order for the offsite entities who have the authority to protect and the responsibility to protect the offsite public, that's when the formal rep would occur.

So in response, if you have a facility that provides less emergency planning zone that was within the site boundary, that is saying that they have no credible accident that would exceed one rem within 96 hours beyond that site boundary.

Hence, you would not exceed a site area emergency and no general emergency classification would be plausible, which is the same as we're doing right now with decommissioning, rulemaking as we go into the different level two and three and so on and so forth. So, it would follow suit with that.

If you determine that you have one rem within 96 hours and you have a site boundary and the licensee can determine how big that site boundary is, that's how we tied it to the area in which the licensee is responsible, that's how it is today.

Then if you exceed that, you would have general emergency classifications.

MEMBER SKILLMAN: Okay, so the answer is

yes, you can have the site where you actually do not get to a general emergency.

MR. KAHLER: That's correct.

MEMBER SKILLMAN: And if I'm a vendor with real deep pockets, I might say, great, I'm going to have a shield building and I'm going to have one of these containments, and then because I'm a safety kind of person, I'm going to have the second containment inside that shield.

And because I've got lots and lots of bucks I'm going to put in a third containment. That's what you're saying?

MR. KAHLER: I am saying if they come up with a technology and a design of the plant site that says that as I go through my accident sequences, I have such the design would render 1 rem within 96 hours within the site boundary because of my design because I've added on to these containments, yes.

MEMBER SKILLMAN: Thank you, that's the point I wanted to make.

Under the right circumstances, the right financial circumstances, one could considerably have site's radiological protection if there is no -- I'm going to use Dr. Bley's term -- there's no numerically defendable basis for release.

I made the release so improbably that I cannot get to that 1 rem in 96 hours and even if the accident continues, I still cannot get that 1 rem in 96 hours.

MR. KAHLER: And quite frankly, we do anticipate those kinds of designs being submitted to us.

MEMBER SKILLMAN: Thank you.

MEMBER BROWN: Just to clarify, I really wasn't -- I was more focused on the onsite multiple units as opposed to contiguous facilities.

The location of contiguous facilities initially as well as what might come down 10 or 15 years later all pose a thing that you just have to address on kind of an ad hoc basis.

But for the initial plant development and stuff, multiple reactors and their configuration of how they're stuffed in poses a different thought process.

And that's what I was really referring to in terms of how much power can you stuff inside these boundary conditions on the site and still consider that there's no criteria that we have to worry about. It's just we're going to evaluate it later at some point.

That just seems to be an open-ended, we're not providing any guidance and it gives the impression that a plant that stuffs 12 plants within 1 building and they're all sitting side by side is 3000 or 4000 megawatts thermal and that's just happy because each one of them is only 200 or 300 or whatever it may be.

So that's the point I was trying to make. It seems to me we ought to have some criteria somewhere. I'm not in favor of everything risk-informed, if you hadn't figured that out by now, or performance-based.

I think that's kind of a caveat and there should be some bottom line that there's a line you don't want to cross, that's all.

MR. SCOTT: I don't think it would be accurate to say and I don't think you were implying that we're not going to consider the potential for accidents at one or more of the --

MEMBER BROWN: I don't know how the other one is going to go right now. I forgot how many plants are on this.

CHAIRMAN CORRADINI: I don't think we want to focus on that.

MEMBER BROWN: I'm not, but it's an obvious example of a multi-unit that's got a fairly interesting configuration. I'm not accusing you of saying you're not going to look at it.

MR. SCOTT: And we are going to look at that. I think the comment is that we haven't put any detail on that and there's no flesh on that right now.

MEMBER BROWN: But this does provide a preview of your thinking if nothing else.

MR. THOMAS: This also goes back to what are the credible accidents and source terms for that extraneous or external to the specific emergency preparedness. The accident happens, what are you doing?

Publicly available documents, Dr. Rempe made a notice that several or a couple of the documents were not made publicly available at the time of the Steering Committee Meeting -- I'm sorry, the Subcommittee Meeting.

The two documents generalized dose assessment methodology for informing emergency planning zone size determinations, ADAMS accession number ML18064A317 and the required analyses were informing emergency planning zone size determinations, ADAMS accession number ML18114A176 were made publicly available on September 21st.

Use of other new technology, during the

Subcommittee Meeting, the Subcommittee stated that the Staff missed an opportunity to define other new technology in the rule and to use it more in the draft regulatory guidance.

The use of the term other new technology is used in the Federal Register notice, their draft regulatory guide, and in other documents.

Next slide, please. The Staff is proposing that Applicants who select to comply with the new rule provide an analysis that supports the requested emergency planning zone size.

The requirements would be in Sections 50.33 and 50.34. For the EPZ size determinations, the size of the emergency planning zone should encompass an area where prompt protective actions such as evacuation or sheltering may be needed to minimize the exposure to individuals.

If the Applicant or licensee demonstrates that the environmental protection Agencies protective action guides are not exceeded at the site boundary, then there will be no NRC requirement for offsite radiological emergency preparedness programs.

If the proposed emergency planning zone size exceeds the site boundary, then for the distance supported by the analysis there will be NRC requirements for offsite radiological emergency preparedness program.

The exact shape of the emergency planning zone would need to be determined in relation to local emergency response needs as they were affected by such conditions as population, land characteristics, and jurisdictional boundaries. The NRC would engage FEMA in accordance with the 2015 NRC FEMA Memorandum of Understanding.

Next slide, please. This diagram provides the overall structure of the rule and its relationship to the existing emergency preparedness regulations. If the Applicant opts to use the proposed regulations in 50.160, then the Applicant would have to provide an analysis to support the specific emergency planning zone size.

If the Applicant demonstrates that the emergency planning zone is within or at the site boundary, then it's shown in the lower right corner of the diagram that the regulations in the proposed section 50.160, Paragraph C1IVP would not apply to the licensee.

If the emergency planning zone would extend beyond the site boundary, then the Applicant would need to address their requirements in proposed

Section 50.160 Paragraph C1IVA and B.

The Staff would then need to engage with FEMA for a review of the offsite plans submitted as part of the license application or a permit application as applicable. There is guidance in the draft regulatory guide that support the implementation of the performance-based regulations.

Next slide, please. This slide describes the Office of Research Support for the development of the regulatory guidance for the emergency planning zone size analyses.

The approach for the scaling and emergency planning zone sizes for small modular reactors and other new technologies was developed to be consistent with the consequences or framework described in NUREG 0396 and the scaled approach use for operating research and test reactors, fuel cycle facilities, and independent spent fuel storage installations.

The Office of Research was asked to review the rationale documented in NUREG 0396 to determine whether the technical analyses described in that document could be generalized to identify a methodology for us by small modular reactors and other new technologies.

The Office of Research found that the

selection of the current planning zone sizes appears to have been based on judgment informed by a variety of lines of evidence rather than being based on a single specific prescriptive dose assessment methodology.

The information from both scaling and reanalysis of the information on potential doses from design basis accidents as well as information on the likelihood and consequences of beyond design basis accidents derive from probabilistic risk analysis were considered in developing the rationale.

Hence, the proposed consequence-oriented approach would provide the same level of protection to the public health and safety as afforded to other currently operating facilities.

CHAIRMAN CORRADINI: So can I stop you right there? The 0396 methodology did not just include NRC, it included EPA and others.

Again, this is personal opinion, so it may not appear in our report but it just seems to me it would be appropriate, I'm trying to look for a better word, but appropriate that the same sort of multi-agency guidance is going to be needed for these advanced technologies.

Otherwise, you're going to get yourself in a potential iterative loop of cycling through proposals, another proposal, another proposal. And it would seem to me FEMA, EPA, and NRC together are going to have to come up with some sort of guidance on this.

If in the current rule you don't think that's appropriate and you simply want to give qualitative considerations, okay, but eventually, it's going to have come to pass that you're going to have to give better guidance because if you look at the authors of 0396, it wasn't just the NRC.

MR. SCOTT: Appreciate that comment, thank you. We'll consider it.

MR. THOMAS: The Office of Research concluded there was sufficient information in NUREG 0396 and its references to identify several key assumptions and elements of generalized methodology for informing the emergency planning zone sizes.

The Office of Research used these key assumptions in the elements to recommend a list of analyses that a licensee would need to submit to justify their selected emergency planning zone size.

Next slide, please. The NRC is proposing ingestion response planning requirements instead of a pre-determined fixed distance as part of the performance-based framework for the ingestion pathway.

The proposed rule would require licensees who comply with Section 50.160 to describe in their emergency plan the licensee's local, tribal, and Federal resources for emergency response capabilities to protect against contaminated food and water for entering the ingestion pathway.

A successful quarantine and removal from public access of contaminated food and water products in response to biological contamination demonstrates that a response to protect against ingestion of contaminated foods and water can be performed in a rapid manner without a predetermined planning zone.

Unlike biological contamination that causes widespread illnesses and only discovered days after infection, a reactor accident would be a leading indicator that long-term actions to protect against ingestion should be considered.

Next slide, please. Now Dr. Carrera will discuss the status in our path forward.

Andy?

MR. CARRERA: Thank you, Kenny, and thank you, Mr. Chairman and Members of ACRS for the opportunity to be here. For the purpose of cumulative effects of regulations, I'd like to provide a quick status and path forward for this rule.

The draft proposal package was submitted to our senior management EDO for review last week. It's in the process of reviewing. As Mike has previously conveyed, we are on track to deliver the cultural to the Commission valve for 12.

The Commissioners would review the packing involved on it so if the Commission approves the publication of the proposed rule, Staff will make any changes to the proposed rule as directed by the Commission and publish the proposed rule in the Federal Register for public comment.

Now, there would be a 75-day public comment period, however, a specific amount of time will be determined by the Commission.

Staff also plans to conduct public meetings during the comment period for the proposed rule to promote full understanding of the proposed rule and guidance, and to inform or facilitate written public comments.

Our staff would consider all public comments received on the proposed rule in the development of a draft final rule.

The Staff will also conduct an implementation period public meeting as part of the cumulative effects of the regulation initiative during the development of the final rule.

Thank you.

MR. SCOTT: Can I just add one more comment?

So I made a comment earlier about a view that we should, and I think the NRC does, encourage risk-informing everything we do to the extent we can but I may have left an inadvertently incorrect impression about that regarding the applicability of the approach in the new rule to large light water reactors.

As we pointed out and Mr. Kenny mentioned, we're putting that out open for comment. However, we believe that the 10-mile EPZ is fully protective of public health and safety for the existing fleet of large light water reactors so we have no information that suggests that we should backfit this new rule or this process or approach on the existing fleet.

So I didn't want to leave a mis-impression of that.

MEMBER MARCH-LEUBA: I'd like to comment on that. My comments on that one were not backfitting the existing reactors but I want to buy an APR1400 and place it in Tennessee. This rule doesn't apply to me.

MR. SCOTT: As I understood it, your

question is whether it should be available to them. I guess backfit wouldn't apply but there's no intention if somebody comes in with a new ABWR large light water reactor design to require that this rule will be imposed on them.

Your question as I heard it is could it be available? Yes, which is a different question.

MEMBER MARCH-LEUBA: That's correct. As written it's not available.

MR. SCOTT: That's correct but open for comment as we go forward.

MEMBER MARCH-LEUBA: I wonder who the stakeholder will be because I want to build an ABWR in Tennessee but I don't have the funding yet.

CHAIRMAN CORRADINI: That's a conflict.

MEMBER MARCH-LEUBA: So who will be the stakeholder that will give you that conflict? A vendor?

MR. SCOTT: We shall see.

MEMBER MARCH-LEUBA: Okay.

CHAIRMAN CORRADINI: I'm going to turn to Dennis. Do you have other questions for the Staff?

MEMBER BLEY: No, I don't, thank you. It was a good discussion today.

CHAIRMAN CORRADINI: Okay, let me go

around and then we'll go to the public. Vesna, any comments? I'll just look at you if any of the Members want to make further comments.

With that, let us turn to the audience here and see if anybody in the room would like to make a comment and then ask if the public line could be open.

No comments from the gallery here? Is there anybody on the public line? If you could please speak up? Okay, the public line is open. With that, I think we're done and I'll thank the staff.

Could you close the public line? Thank you very much and we'll take a break. We're back at 10:15 a.m., to stay to the published schedule.

(Whereupon, the above-entitled matter went off the record at 9:42 a.m. and resumed at 10:15 a.m.)

CHAIRMAN CORRADINI: Okay. So let us come back together here for our second topic, which is summary of reactor operating experience. I'll turn -- excuse me. We'll start again. We'll begin with our session on summary of reactor operating experience. And we'll turn it over to Member Skillman to lead us through this. Dick.

MEMBER SKILLMAN: Thank you, Mike.

Colleagues, what we're going to do here is two things. We're going to bring you up to speed on 2017 and mid-year 2018 fleet performance. And I want to leave some time, about 20 minutes at the end of the session, for the topic of leading indicators.

If you recall, Matt and I have been kicking around this idea, perhaps others, of how do you know when a licensee is entering into degrading performance. And we want to talk about that. And so we've got really two presentations back to back. And we expect to finish by 1200.

Okay. So last year or last December we caught up with 2015 and 2016 data. The purpose for today is to talk about 2017 and half of 2018 for which data is available. Next slide, please.

Just to remind everybody, the reactor oversight framework really focuses on seven cornerstones.

So, for those of you who have been out on the fleet and those of you who watch from a distance, the cornerstones are the initiating events, that is what gets the thing, the event started, what are the mitigating systems, in other words, what are you depending upon to keep those systems functioning so that they perform their appropriate function, issue of barrier integrity. Emergency preparedness is a standalone of a cornerstone. Public radiation and occupational radiation are key for radiation safety, and finally, security.

And so we're going to talk about all of those in the next approximately 45 minutes. Next slide, please.

What is the reactor oversight process? You see the NRC inspection block on the upper left. What that is doing is it's feeding the information from the site.

And those actions include just regular inspections that are part of the normal day-to-day activity by the residents. If there's a finding, there can be a supplemental inspection. If there is an event at the site, the NRC may send in an advanced team for event response.

There are the generic safety inspections that are the day-to-day cadence of the site. And then there are other inspections that may be called up if there is an event or circumstance that requires further review.

All that information finds its way up through a significance determination process. And if this significance determination process reaches a certain threshold, there may be enforcement.

All that information goes up into the assessment process. There's an action matrix. And this is a living process. This isn't something that's done once every Tuesday or once a year or once every five years. This is an around-the-clock, continuing performance.

You've got residents onsite finding information, licensees performing. And the process operates at the site as long as the site has a license to operate. Next slide, please.

How many plants are involved in this? 101 is the answer. You can see the breakdown by region. And those are all Part 50 licenses. And they are all susceptible to or, if you will, under the magnifying glass of the ROP. Next slide.

So something happens at the site. What does that event mean in terms of safety significance? What does that event mean in terms of safety significance?

Well, you see at the bottom green. Those are events that happen or findings that are discovered whose impact in terms of core damage frequency are less than or equal to 10 to the minus 6, one in a million CDF, or LERF less than 10 to the minus 7.

If the significance of that event reaches a decade greater, that event will become a white finding, and if it's a decade greater, a yellow finding, and if a decade greater than that, a red finding.

And I can tell you from years of experience, licensees wish to be at green all the time. Occasionally, there will be a white. When a licensee has found himself/herself in a yellow or red, that is extremely significant. And we'll see more of that as we proceed.

MEMBER MARCH-LEUBA: Is there a difference if it is self-reported or if it's found by the inspectors?

MEMBER SKILLMAN: Well, the application of the violation or the penalty may be affected by how the licensee responded to --

MEMBER MARCH-LEUBA: So you want to see the white, yellow, or red, but you will get the lower finding if you're self-reported.

MEMBER SKILLMAN: Well, actually, to Derek's credit, we've got a slide coming up for that. But it really has to do with what is the Severity Level IV.

But on the slide to instruct what is a

Severity Level IV, you can see how a Severity Level I, II, and III, which would get us into yellow, white, red or red, yellow, white, would be handled. And that will answer your question if you just give us a second here. Next slide, please.

What's a green finding? That's maybe someone failed to sign off on the right line of a procedure.

What's a greater-than-green? Greater-than-green only applies to security. So hold that thought for a second.

White, yellow, and red. Now, white is a moderate safety significance. Yellow is substantial. And red is a high safety significance or a security significance.

Back to greater-than-green. So let's say in the security area the inspection program discovered a major flaw in plant security. It's certainly greater-than-green. It might be white, yellow, or red. But that information is SUNSI.

And so for all security findings that are greater-than-green, they are simply identified as greater-than-green. And those more significant security issues are handled SUNSI. That's why you just see GTG, greater-than-green.

Does that make sense to everybody? In other words, if it's a bad security item, you don't want to paint it in the paper. You just simply say it's SUNSI.

Now, security will also have or can have white, yellow, or red. They're just identified as greater-than-green. Next slide.

This is a busy slide, but in a way it's not. If you look at a Security Level IV violation on top, this is to answer the question what is a Security Level IV or what's beyond greater-than-green. If you see the first block is -- I've got to read my own slide here. I've got to increase the magnification.

The first block is fail to restore compliance, yes or no. This is a Security Level IV. And if the answer is, yes, they failed to restore compliance, that may lead to a violation, notice of violation. So that is the blue line under the green blocks on top. And if you see the D, that is discretion. The NRC reserves the right to make a determination of the consequences or the circumstances of that particular failure.

If the licensee did not fail to restore compliance, in other words restored compliance promptly, so the answer would be no on that first diamond, then did that licensee fail to place that item in the corrective action program, yes or no?

So, if the licensee identified the item, put it in CAP, restored the issue, you keep moving to the right. Is it repetitive, yes or no? If it's not repetitive, it's a first time finding, the answer is no. Was it willful? Did someone actually do this on purpose? No. In that case, if you go all the way to the right on that first set of diamonds, that's a non-cited violation.

And that will be true for every non-cited violation that is a very low threshold level. Those might be just NCVs. And you see those all the time. That's an NCV, a non-cited violation.

And if you note also on the left-hand side of this slide, the first line is for power reactor licensees. The second line item is for all other licensees. Those could be for research reactors. Those could be for medical facilities, things of that nature, for all of the other licenses that are not Part 50 power licenses.

Also, notice at the bottom of the slide is the escalating process. This is for type I, II, and II, severity I, II, and III items.

And in that process, you see that the

inspection protocol is essentially the same. But as you get more deeply into the escalated process, you determine whether or not it's a first willful, was it identified, is there credit for corrective action and so on.

And then, you know, in the grimmest day, you can end up in the lower right-hand corner where you've got a notice of violation and a very significant two times the base penalty.

What I also want to point out here, and it's subtle, but if you understand how the regulations function, this idea of credit for identification. And it's in the second diamond on top. It has to do with placing the issue in CAP.

What is CAP? That is the corrective action program. And that is Criterion XVI of Appendix B to 10 CFR 50. That's the QA program. That's the thing Harold and I keep asking about.

Where is leadership in understanding Appendix B to 10 CFR 50, because sites that are really tuned in on Appendix B and have a very healthy corrective action program and have a culture that feeds the corrective action program, you normally find those sites with some non-cited violations? But they're normally running along that top line. Next slide, please.

Okay. 2017, and what you're seeing here is the four previous quarters in 2017. And what you're seeing is four yellow findings. And if you recall, those are just below red. That's in calendar year 2017. And you see eight white findings. You also see six greater-than-green.

So you can get an idea of what the population is. And notice that the yellows in 2017 are initiating events in mitigating systems. The whites are initiating events, mitigating systems in emergency preparedness. And I'm going to just tap on those just for a second.

There are inspection reports to back up the information that I will indicate. But I'm just going to go over them quite quickly. Next slide.

2018, there is only one white, and there are five mitigating systems. And there are three greater-than-green. Now, this is looking back four quarters. So those three greater-than-greens are either all in 2018 or could be part of the last two quarters of 2017. If you check the prior slide, there were six and eight in 2017. It looks like those three are only in the first two quarters of 2018. Next slide.

So, going back to 2017 for those four yellows, those four yellows came from Arkansas Nuclear One and Two, Arkansas Nuclear One, which are One and Two. Those came from calendar year 2015 and '16.

They affect initiating events and cornerstones. And they carried over into 2017. In other words, they had not been closed out.

So, even though the events were a year or two earlier and then had to do with the dropping of the rotor and the compromise of some flooding barriers in the unit, those carried over into '17 until the CAL had been issued and closed out. The CAL is the confirmatory action letter. Those have been resolved so they don't show in 2018. But those four yellows showed in 2017.

So what were the events in 2017 or that were carried in 2017? It was the failure to follow the material handling program when they dropped the Unit One stator. And that resulted in the loss of off-site power in Unit One and Unit Two. And it demonstrated -- if you recall, it severed a fire main and they had some major flooding in lower levels at the plant.

And as a consequence of this event at Arkansas, they were placed in column 4 of the matrix.

And they were going to do a supplemental, a 95003.

The 95 series of inspection procedures are the ones where there is significantly enhanced NRC inspection. There is a graded performance from 95001 to about 95002, then 95003.

And if a licensee were to find himself or herself in 95003 and still be wanting, then the NRC could take the keys for that unit and put the unit in 0350. And that has happened. That's happened to several plants. Finally, next slide, please.

ANO also was in a situation with the, with unplanned scrams. The site was finally inspected this past May, a couple months ago. All of the actions for ANO have been completed. The CAL was closed. And they've been moved out of that action matrix column. And that is reflected in the 2018 data from a few slides earlier. Next slide.

There were the eight whites that showed for 2017 and '18. Here are the plants that are identified for those whites. Two plants had initiating event cornerstones. They were Grand Gulf and St. Lucie.

There were five in mitigating system cornerstones, Catawba, Clinton, Oyster Creek, Perry, and Pilgrim, and we'll get each of those in just a minute, and one plant with emergency preparedness cornerstone, and that was Fermi.

So here's the data for these eight events. At Grand Gulf, this was scrams. They had a number of scrams. And the real issue there was the poor root cause analyses.

At St. Lucie, it was configuration control. That's Criterion III of Appendix B to 10 CFR 50. It resulted in the reactor trip and loss of power, a major change in core damage frequency. Next slide.

Catawba, it had to do with the excitation system for emergency diesel generator. At Clinton, it had to do with the drop out voltages for replacement relays with an EDG room vent fan. As a consequence at Clinton, the EDG became inoperable. Next slide.

At Oyster Creek, it was the failure to follow manufacturer's instructions on reassembling the electromatic relief valve. And at Perry, it had to do with failure to evaluate the effects of a suppression diode.

Now, what's interesting is when you read the inspection reports and you read the licensee's response, there's a very healthy amount of dialogue between the two where the licensee says, well, that's not exactly what happened, here's what happened. The NRC comes back and says here's the basis for our findings.

And so there's a negotiated agreement for how in this case the white findings are finally dispositioned. So this isn't just a cop coming in from the NRC and saying, bingo, you've got a white. There is back and forth to finally arrive at the color finding.

And you got to realize for a site to get a white or a red, that has major implications, perhaps in insurance, in the in-post standing of that plant, and other similar things. So these are very serious events for the licensee. Next slide.

Pilgrim was a failure to correct issues pertaining to a safety relief valve. And this event went on for a fairly significant time. That's Pilgrim. Next one, next slide.

And at Fermi, it had to do with a background radiation monitor. And as obscure as that radiation monitor issue might have been, that was a monitor that was depended upon for making a call regarding a PAR, a protective action recommendation, out of the EAL.

So here's the case where a relatively

obscure instrument plays a major role in the site leadership's ability to create an accurate emergency action level classification and develop the protective action recommendation for the emergency, resulting in a white at Fermi. Next slide.

For 2018, no more yellow findings. That means that the ANO yellows have dropped off in 2018. And there is just the one white coming over in 2018. And that is a mitigating systems cornerstone finding at Davis-Besse.

In that particular case, it was an auxiliary feedwater turbine bearing gauge glass oil issue. And they failed their feedwater pump. And as a consequence, there were maintenance issues. But the main thing is that the pump was inoperable for greater than the tech spec period. That is the white at Davis-Besse for 2018.

Now we're going to talk about the security cornerstone. If you go back to one of the earlier slides, you saw security as a cornerstone, number 7, sitting far on the right.

Derek, can you expand this? Can you jump out of presentation and just put it on, hit escape and that will go to --

(Off mic comments.)

MEMBER SKILLMAN: And in the lower right-hand corner you can move the vernier and it will expand this.

What I wanted to show up and down is you can see the extent of the baseline inspections for security. And I would offer that if you haven't lived at a site or spent time in a site, you probably wouldn't appreciate how much work is done on this cornerstone.

And I will tell you the inspections are thorough. The site leadership is tuned in to all of these pieces. And you will find, as you go over each one of these, it has to do with who can get in, who can get out, what information there is, how the security force is trained, where their weapons are stored, how the information is protected, how they prepare for their force-on-force exercises, the fitness-for-duty program.

Second from the right on the lower corner there, the target sets, this information in the last 40 years has begun or has become basically as large as operating the plant itself.

And if you were to go site to site, you would be quite impressed at how large the security teams are to protect the core and to protect the people who are working at the site. The security cornerstone is really a significant piece. Next slide, please. Derek, thank you for doing that.

Okay. So plants greater-than-green, there were four in 2016, in calendar year '16. There were three in '17. And data for mid-year '18 is three.

Greater-than-green is not a new category. It just means the finding was either white, yellow, or red. And the details are SUNSI. So they're not publicly available. Next slide.

This will give you an idea of how many inspections were completed in 2017. You can see that the number is not trivial. This is a major effort by the Agency. And it's a large effort by the licensees to support these activities.

So, of 250 inspections, there were 3 findings greater-than-green in 2017 in the power reactors. In the fuel cycle facilities, there were 15 security inspections. And there were 4 Security Level IVs. And there were no greater-than-greens. Next slide, please.

And this is just force-on-force. Within the security cornerstone, these are the, if you will, the inspections that really tell the tale. This is where you determine the effectiveness of your security team. And that will give you an idea of how many inspections were conducted in 2018. Next slide, please.

And this aligns with the prior slide. One exercise was ineffective. There were three that were marginal. And all of the licensees took appropriate corrective actions. And those corrective actions include procedure changes, policy changes, updates, technology improvements, and personnel or security force enhancements, all kinds of things. Next slide.

The NRC reviews cross-cutting issues. If you go back to the second slide, cross-cutting issues cut across all of the seven cornerstones. And the NRC evaluates whether there are cross-cutting issues. And they do that twice a year at mid-cycle and end-of-cycle. There were no new items in 2017. And the data has not been reported yet in 2018.

This is an important feature of the ROP because it prevents group think. It kind of takes the inspection to maybe a 100,000-foot level to look at the entire available information to make sure there isn't something that is emerging that is evading or failing to be recognized. Next slide, please.

Safety cornerstones, how you think about these things. You can see initiating events. The performance indicators are as you see on the right. I'm not going to read all of these. But you can see those cornerstones and what it is that is being measured to assess the robustness of that cornerstone. If no questions, next slide, please.

Performance indicators. Green is where the performance is within an expected level and where all of the objectives are met. And every licensee has a whole set of performance measures and indicators. And those are, if you will, observed or watched on a daily and continuing basis for all the cornerstones.

White means the performance, it's outside the range where you want to be, but the basic objectives are met. Yellow is there is a reduction, a minimal reduction in safety margin. And red is where there's a significant reduction in safety margin. Next slide.

For 2017, there were no plants with red or yellow. And there were two with white. And we'll show those in a minute here. Next slide.

At Columbia, the trigger was unplanned scrams with complications, not scrams, but scrams with complications. A scram is acceptable, in fact, required within the, if you will, the operating experience of the plant. There are times when you've got a scram and the plant goes down.

The issue is was there a complication. And that complication could be equipment failure to operate, the operator's failure to --

MEMBER MARCH-LEUBA: Is the complication after the scram or the complication results in the scram?

MEMBER SKILLMAN: After the scram. So you get the buzz. The rods drop or insert. And now things go south very quickly. TMI-2 was a perfect scram with complication. Down it went, bam, floor opened. No one saw it.

So this is scram with complications. And at Columbia, it happened twice. It happened in the fourth quarter of '16 and third quarter of '17. Hence, this became a white. Next slide, please.

And at Watts Bar 2, now Watts Bar went online in late 2016. So we haven't accrued enough hours. But they were struggling. And you can see that they were in a situation. And what you do is you do the average for the four quarters. So they were scramming I guess quite regularly coming up from their extended, if you will, construction and come back online as a power reactor. Next slide.

Performance indicators for 2018, there are no red or yellow or white through January to June of 2018. Next slide.

So, in the action matrix, you take the inspection findings and the performance indicators, and that gives a plant assessment. Next slide.

All right. So every once in a while you read a news release that such and such a plant has been moved from column 1 to column 2 or it's moved from column 3 to column 2. This is what those columns are. Column 5 is basically you're an 0350. You've -- the NRC has taken your keys. Davis-Besse was one of those.

Column 4, you've got multiple/repetitive degraded cornerstones. We'll talk about two plants that found themselves in column 4.

Column 3 is degraded cornerstone. Column 2 is regulatory response. And you can move, if you will, from 4 to 3 to 2 to 1 depending on licensee performance and how the licensee resolves the issues that put the unit in the cornerstone category where it once was.

And, of course, the licensees want to be in 1. That is where the licensee is responding. And there is no supplemental NRC regulatory oversight at that site. Next slide.

And you can see on this slide, column 1, lower left-hand corner, all performance indicators green, column 2, no more than two white, column 3, one degraded cornerstone. It could be three whites or one yellow and three whites in any strategic area. Four is multiple/repetitive degraded. And 5 is unacceptable performance.

And if you look in the right-hand column for licensee response at the bottom column 1 on the right-hand side, that's your normal and routine inspection. You've got your inspectors. There is a baseline inspection program. There's annual assessments. And there's public meetings.

If you're in regulatory response column 2, you've got a meeting with NRC management. And I would tell you, for those of us who've had to go to those meetings, they are very uncomfortable. It's not because it's pejorative. But it's because there's an issue that the site has just not been able to get a hold of. And it's very objective. But it's clear the burden is on the licensee to make the changes that are necessary to bring the plant back to column 1.

And as you escalate on that right-hand corner from bottom to top, I would say there are two things going on. The culture at the site is put to the test. And the amount of resources that are necessary to bring the plant back to column 1, at least I would say, increase exponentially.

Once you get into a situation where you're in column 2 or column 3, you are facing some very significant costs to bring that plant back to where you want to be. And I'm not talking a couple hundred K. I'm talking millions and sometimes many millions of dollars to bring that plant back.

And so the consequences are very significant for not keeping the plant in that all green category. Next slide.

So, if you look at 2017, if you do the arithmetic, you'll find there are 101 plants represented there. And first quarter of 2017, it was 82 in licensee response, and that's green. Sixteen are regulatory response, and three in multiple/repetitive degraded cornerstones. The three plants are Arkansas One and Two and Pilgrim. And that cadence continued through all four quarters of 2017. Next slide.

In 2018 for two quarters, 95 in licensee response, all green, 5 in regulatory response, and 1 in multiple degraded cornerstones. That is Pilgrim. And we don't have the second quarter data yet. So let's talk about this. Next slide.

So the highlight here is Arkansas Nuclear One and Two are back in column 1. Why? They completed their CAL actions, their confirmatory action letter requirements, and they brought the plant back. And they went into a 95003, a huge amount of effort to bring that plant back to where it's in column 1, the first time since 2015.

Now, the next slide is the lowlights. This is where you've got to be thinking what's going on. Pilgrim is six consecutive quarters in 3, 13 consecutive quarters in column 4.

And if you take a look at the inspection reports and get just an understanding of what the cadence has been at that plant, it's kind of a poster child for how things should have been handled and weren't in terms of corrective action, in terms of work management, in terms of material condition.

And Derek offered that NRC muted response considers Pilgrim's plan to shut the plant down. That is a major, that's a major item for the industry right now.

And Grand Gulf and Clinton and Columbia, consecutive quarters in column 2, believe me, the owners of those plants are eager to bring those plants back into column 1. Next slide.

Fitness-for-duty, I don't know if this was done, if this presentation occurred back when Jack Seaver (phonetic) was providing these presentations. I recall the first time I did it I said I'd like to present the fitness-for-duty information because of what I witnessed in terms of the change in the culture in my years.

But I find this interesting, because what is happening at the plants is in a way indicative of what's happening in our culture. It doesn't make any difference whether it's in a power plant, police department, hospital, large employer with high tech.

There are things going on in society that are driving this data. And to me, it's maybe a thermostat of the culture at least in terms as we view safety, in terms of the high tech business, could be driving a bus, flying an airplane, operating a tank, flying a fighter aircraft, being in a control room.

This is our culture. And so that's why I was so eager for this to be part of this discussion, because, you know, I live ten miles from a nuclear power plant. I know the people who are working down there. I -- firsthand stories of what was going on. But the data shows up here. And our neighbors and friends know this is going on.

So our knowing about it I think is valuable. And that's why it's here. Next slide, please.

There are five types of tests. There's pre-access. You know, you apply for a job. You fill out the form, say, no, no, no, no, no. And you get admitted as an employee.

Then the day comes you have a random. And, oh, yeah, yeah, yes, I had some of that last weekend and I probably shouldn't have.

And then there's the unfortunate event where you're working and your colleague is not functioning on all eight cylinders. And as a manager or a director, you're put in a position to have to make a decision to call security and go and visit that person. And I've done that. It's very uncomfortable. It's even more uncomfortable when the discovery is a positive.

And then there is the we had a scram, and four people were involved, and we're not quite sure, and someone was injured. Then you might do a post-event, because there's been human error, to determine whether or not drugs or alcohol were involved.

Then there's the follow-up if you had a

positive. And they have a follow-up after the positive to see if you're clean or not.

That is alive and well at every nuclear power plant in the country. It's alive and well in this building by the way. So those of us who have been called, that's where we are. Next slide.

So there were data for three years. There were subversion attempts. Do you know what that is? That's where someone tries to either alter their specimen or give somebody else's specimen or do something like that. It happens all the time.

Amphetamines have been increasing. And construction sites have the highest positive rate, particularly in pre-access. This is where you got 200 laborers coming on board. And you're required under Part 26 to do some screening. And lo and behold, you screen out 10 or 15 of these people because they, for doing drugs from their last construction site. And they've had a big weekend. And they came in on a Monday morning. And there they are. They get caught. Next slide.

The NRC submitted a proposed rule for consideration that would address three multi-year trends by lowering the cutoff levels for amphetamine and methamphetamine and expanding testing measures related to subversion as an attempt to not be detected.

There's no Commission response yet. But that SECI is up there for consideration. In other words, it's a trimming of the rule. Next slide.

So the data tells a story. So there is an increase in subversion attempts. And, you know, you stop and say what does that mean. Well, it means -- does it mean there are more people doing drugs? Probably. It means more people doing drugs or trying to hide doing drugs.

And I would just sense that this data is probably applicable almost anywhere you might travel in a high tech industry.

And at the bottom there, 45 facilities with at least 1 subversion attempt. How many facilities are there? What is it, 67, 68 facilities in the country? So three-quarters of the sites, facilities have at least one subversion attempt. Sixty-seven are pre-access. And 98 percent of those are contractors or vendors. Next slide.

There's an overall positive rate around .75, .77, .76 percent. It's low, but it continues upward. There was a slight reduction in calendar year '17 total tests. There's a continuing downward trend.

About 64 percent of the calendar year '17's positives and refusals occur pre-access.

For those of you who don't know, if a contractor comes in and you're asked to go give us a specimen, there will be some who will say no thanks. And they'll take their lunch bucket and their backpack and go back to the parking lot and leave the site. They'll just say, no, I'm not taking that test. That happens.

And the randoms identified about 22.7 percent, one-fifth of the abusers. And that next to the last caret identifies more employees using substances than pre-access. That is what is alarming to me.

We have a culture, not only in nuclear but throughout our society, where there are a lot of people using substances, these substances that are banned. Next slide.

For-cause testing continues to have the highest positive rate. That is where a supervisor or someone points out an employee that needs to be escorted to the fitness-for-duty station. And the substances that account for about 85 percent of the positives are marijuana, alcohol, and cocaine.

I would just say back in 1966 when I

started that we were concerned about people coming on the watch that had a couple beers. I don't know. I don't even remember these words. Marijuana was something that happened in California. Those of us from the east didn't, at least I didn't know about it in '67. I got my RO in '67, so never even thought about it. And here --

(Off mic comments.)

MEMBER SKILLMAN: Yeah, that's, I mean, that's a culture I wasn't part of.

(Laughter.)

MEMBER SKILLMAN: Yeah, I'm just saying the reason I wanted to show this is because I think it's something that we as serious, engaged, active professionals just need to keep in the back of our minds. It's a shame that the culture is here. But this is where it is. And this is where we live. We need to be aware of it.

MEMBER SUNSERI: Hey, Dick, does the data suggest that since the legalization of marijuana in several states is contributing to the trend in marijuana use, or is there, is it indifferent to that?

MEMBER SKILLMAN: Matt, that's a great question. I think it's too -- this is Dick Skillman's opinion. I think it's too soon to tell, because, you know, it's just beginning to be legitimized as a medical treatment. I don't think we've seen the data yet that would be the result of those changes.

I know I've been kind of watching Exelon. And they're saying we're not changing our standards. You know, if you're taking medical marijuana, recognize you can be called to fitness-for-duty on Monday morning. So medical or not, if you show up positive, you're going to, you're either not going to have a license or you're not going to be working here.

MEMBER SUNSERI: Yeah, I understand that about the medical. But I was thinking, you know, so you got Colorado, Oregon, you know, California.

PARTICIPANT: Massachusetts.

MEMBER SKILLMAN: So the reason I wanted to present this information is so we can kind of have this conversation and say what's going on here. You legalize marijuana. You go to a football game at State College and you smoke up all Saturday afternoon. And you come back and take a security watch on Monday morning. I'm not sure. That's the issue.

VICE CHAIRMAN RICCARDELLA: You know, the other issue is, you know, evidence of marijuana can stay in your bloodstream for 30 days, you know. And it doesn't really, you know -- if you're at that football game 30 days ago, it's not clear to me that it affects your performance. But it is what it is, I mean.

MEMBER SKILLMAN: Next slide, please. Fitness-for-duty data, understand that if you're at a site, if you're a director or manager of a site, you've got some very clear guidelines for how you handle this information.

Once the employee has been sent to the fitness-for-duty station, if there's a positive, there are all kinds of reportings that do occur. And so this will issue a fitness-for-duty as I think kind of taken over at least a large portion of how the site thinks about its health.

What is important is that for 2017 there were 33 24-hour reportable events and half of those are supervisors and managers. That's alarming. At least I find that alarming.

And so, you know, what do you do if you've got a very key manager upon whom you depend for key decisions and you find that individual positive? Then you enter your program, fitness-for-duty, that might take that person off site for 30 days. There are major issues associated with this whole topic.

So I just wanted to present this so that the members have a sense of perhaps what the site leadership and the site executives have to deal with, but also what the NRC staff has to deal with. Our culture has changed. Next slide.

Annual abnormal occurrence report to Congress, there was one, one item. This was an Americium-241 ampule, probably as big as your little finger, that leaked on a lab table up the street here up at NIST in Gaithersburg. And that resulted in an overexposure. That is the only abnormal occurrence that has been reported. Next slide.

Colleagues, any questions? Okay. Don Helton, we're ready for you to come forward, please.

This is the second piece that I wanted to talk about. And this is the topic of leading indicators. Matt and I were kind of working our way into this. I've got some strong feelings about what is a leading indicator for future performance.

When I look at the identification of the problems that ANO and at Pilgrim, you know, my own involvement with 95002 and 95003 plants and 10350 plant, my view is that there are some items in the culture at the site that will point to degrading performance. And the question is at what magnitude.

And that is what kind of triggered this

discussion. Could we actually make a rubric or some kind of a formula where you would say if you take a look at these data over a reasonable time period, could you predict that that licensee is going to go into a ditch? I believe the answer is yes. But that's what I wanted to talk about here.

MR. BOWMAN: Yes, so neither of us are Don Helton in case you haven't realized that. I'm Greg Bowman.

MEMBER SKILLMAN: I thought Don was going to make the presentation. So --

MR. BOWMAN: So I'm Greg Bowman. I'm the Branch Chief for the ROP Assessment Branch --

MEMBER SKILLMAN: Okay, Greg.

MR. BOWMAN: Tom Hipschman is the Branch Chief for our Inspection Branch. And so Tom is going to go through the first part of our presentation talking about, you know, how our inspection program picks up on degrading performance, whether it's due to financial challenges or whatever.

And then I wanted to give a brief discussion at the end about some recent developments on ROP enhancements. We've gotten a lot of -- we're in the process of dealing with a lot of proposals from our stakeholders, both internal and external, for ways we can make the ROP better.

And so we really just wanted to give you a, you know, heads-up on something that's coming down the road that you'll likely be involved in, you know, helping review our, whatever we come up with. So --

MR. HIPSCHMAN: Thank you.

MEMBER SKILLMAN: Please proceed.

MR. HIPSCHMAN: Hi, I'm Tom Hipschman. I'm the Chief of the Inspection Branch. This is my first opportunity to present to the ACRS.

I took over the branch back in February of this year. Previously, I've been a senior resident inspector at Indian Point, Diablo Canyon, the resident inspector at Oyster Creek, a regional inspector and also a regional branch chief and served on the Commission as a TA.

I'll just kind of fill in a little bit of my perspective. It was a very good overview of the ROP. So I'm not going to reiterate a lot of that.

But the ROP is designed as a process that we use to identify declining licensee performance prior to the loss of reasonable assurance or adequate protection.

In part we do that by plants that will progress through the action matrix, so columns 2, 3, 4, or possibly even 5. So we have increasing levels of Agency response and oversight and management oversight.

We also apply additional inspection resources in response to greater-than-green findings. And roughly our 9500X procedure, such as 95001, would be used for a white finding, 02 for yellow, red for 3 roughly.

And throughout those inspections, every quarter following completion of the 95003 there will typically be a confirmatory action letter. The regions will send out several inspectors on a quarterly basis to do CAL closeout. Additionally, there will be probably annual problem identification and resolution inspections.

So there's quite a bit of additional resources applied to plants that increase in the action matrix.

MEMBER SKILLMAN: Tom, how many plants have been subjected to 95003? I'm thinking 5, 6.

MR. HIPSCHMAN: I don't have a number off the top of my head.

(Simultaneous speaking.)

MEMBER SKILLMAN: It's not 20. It's not ten.

MR. HIPSCHMAN: No.

MR. BOWMAN: I'm thinking probably five to ten.

MR. HIPSCHMAN: Just off the top of my head, Pilgrim, ANO --

MR. BOWMAN: Cooper.

MR. HIPSCHMAN: -- Indian Point.

MR. BOWMAN: Browns Ferry.

MR. HIPSCHMAN: -- Cooper, Browns Ferry, Fort Calhoun. Those are the ones that come to mind.

MEMBER SKILLMAN: So maybe it's 6, 7 out of 100.

MR. BOWMAN: Yes.

MEMBER SKILLMAN: 6 or 7.

MR. BOWMAN: Since the beginning of the ROP in 2000.

MEMBER SKILLMAN: Yeah, okay. Thank you.

MR. HIPSCHMAN: So, notwithstanding, there's been always interest in leading indicators. The Commission in various forms has encouraged the staff thinking about this. I know my former boss was also very interested in leading indicators.

We do routinely assess the effectiveness of the ROP through annual self-assessments, biannual procedure self-assessments where we look at procedures, inspection procedures and findings.

Additionally, as you mentioned, there is an annual assessment meeting that all the regions perform where they review each plant's performance. And they have various discussions about certain areas of concern. Next slide.

There have been -- various discussions have highlighted ideas as, you know, what can we do. Can we look at the trend and the number of green findings? While there are some plants that tend to have greater number of green findings or challenges, we haven't historically used that as any kind of trigger for increased oversight.

However, again, it is an assessment piece that the regions will look at during end of cycle meetings.

One aspect that sometimes has been suggested is looking at cross-cutting aspects. With those findings you will tend to accumulate in certain areas, such as human performance or problem identification, a number of cross-cutting aspects that could give you insights into licensees' performance in a particular area.

Other areas of findings that might be of interest are QA, Appendix B related findings, maintenance rules. Other areas that the NRC is interested is plant operations.

(Background noise.)

CHAIRMAN CORRADINI: Just so you know what's going on is that the wonderful system here cuts out if there's no communication. So we lost a member out in the far west. So we're going to try to reconnect. So I apologize.

MR. HIPSCHMAN: All right. So proceed or --

CHAIRMAN CORRADINI: Keep on going.

MEMBER SKILLMAN: Please proceed, yes.

MR. HIPSCHMAN: Plant operations, you know, we'll look at --

PARTICIPANT: Do you have a question?

MEMBER REMPE: I do, but I thought you were going on to the next slide. When you finish this slide, I have a -- oh, I'll just say it now.

On some of these things where you're talking about discussions of using the data, is there something that could be done? Like right now a hot research area is big data, right, and using some sort of system to help you analyze it.

Has that discussion ever gone that way that maybe there's something that research could do to help you use this data more effectively?

MR. BOWMAN: So, when we get to the transformation discussion or the enhancement discussion at the end, some of those suggestions have come in to us. We haven't made a lot of progress on, you know, shipping that work over to research to help us with. But we do need to assess that as one of our ROP enhancement proposals.

MEMBER REMPE: So --

MR. BOWMAN: Most of the things that Tom is discussing on this slide are already looked at as part of our inspection program, so, but not from a big data standpoint, not, you know --

MEMBER REMPE: So that's something that's coming up in the DOE arena with industry. And so there might be, and we can talk about it later, but with some collaborative efforts --

MR. BOWMAN: Yeah.

MEMBER REMPE: -- with the Department of Energy.

MR. HIPSCHMAN: With regards to plant operations, inspectors will keep tabs on various things such as work management. They'll look at the number of corrective actions or corrective maintenance in the backlog. They'll -- some plants tend to have higher backlogs than others. You know, anecdotally, that could be sort of an indication.

Other things that occur are to help the inspectors relate to operation of the plants and material condition of the plant. Some plants are in obviously better condition and better upkeep than other plants.

And one way that inspectors can be aware of that is that they will do annual objectivity visits to other sites so that they can get comparisons on how both residents and also other plant managements are performing.

Also, there are frequent regional management visits that, you know, are also very instructive for the resident inspectors. Just on the list, you know, there's other things that the inspectors can trend.

Interestingly, you know, staffing resources such as, you know, what kind of license operator pipeline is there is kind of also an indicator of how well or, you know, of what's going on at the plant. If there's a lot of license operators in the pipeline or if there's a healthy number of senior reactor operators, you know, that typically seems to be a good indicator.

You know, trend and conditions, 5072, 5073 reports, again, those are sort of, those are things that inspectors follow up on. They also will do an inspection of those after the fact. And that is also reviewed during end of cycle meeting.

One of the outcome of end of cycle meetings are senior management key messages that the regions will develop. And they're sort of talking points for when the regional senior managers go out to the site. They're areas of performance that they would like to emphasizes during their site visits.

MEMBER SKILLMAN: Tom, let me ask this, please. When Matt and I were trying to develop some energy around leading indicators, the question that was foremost in my mind is, has the staff ever taken all the 95003 plants, just remove the name, just take the data that were the initiating events that got the plants in the 95003 and compared them and asked the question are the conditions that brought the plant to 95003 similar enough that those specific conditions would themselves become a leading indicator.

For example, at least one man's opinion, the robustness of the system health reports, the degree of connection between the corrective action program and the work management program and the expressed beliefs by senior leadership and their knowledge of the Appendix B to 10 CFR 50, I keep coming back to that, those plants where senior leadership understands that Appendix B is 18 pieces. If you pull them together right, if you've got a strong corrective action program and a strong work management program, you might get a lot of greens, but they're in the grass because people are taking care of stuff, little things that happen.

But you're also moving the bigger items into strong root cause evaluations. And you're actually fixing the underlying problem as opposed to repair and move on.

So my real, the question I would ask is, have you ever or has the staff ever considered looking at the six or eight or ten 95003 plants and the one 0350 plant -- I don't know how many 0350s, but at least one -- and asked is there any common set of findings, which if given even a thicker magnifying glass, might produce a fairly short list of leading indicators.

My view is the answer would be yes. But, and I would sure like to have the time and energy to do that study, but I don't. But it seems like that's a gold mine.

MR. BOWMAN: Yes, so -- I'm not aware of us having done a study like that. It's a great question.

When we get to the -- and I hate to kick everything to the enhancement discussion we're going to have shortly. But we've got a number of suggestions both from internal stakeholders and from external stakeholders about our performance indicator program and whether that's where it should be, whether it's giving us meaningful information.

And one of the things that I -- this is just -- we haven't actually kicked off the review of that yet. But I think doing something like that is, would be very valuable in determining whether we can identify different performance indicators or better performance indicators to help us in that area.

I think that's something we had planned. We haven't really done that yet. I'm not aware of us having done that historically.

But as we look at the performance indicator program in the context of our opening enhancement, I think that will be a very fruitful exercise, going through and seeing, you know, what 95003 plants might have been experiencing before they got there. That's a good, very good suggestion.

MR. HIPSCHMAN: Yes, I'm not --

MEMBER BLEY: Dick, can I cut in sometime?

MEMBER SKILLMAN: Yes, sir. Dennis, good to hear from you. Please.

MEMBER BLEY: Yeah, well, I've been locked out for a while. I finally found out why. I'm back.

This business of leading indicators has been a hot topic since at least the mid-70s. And the NRC sponsored a lot of research back in the 80s on this, so have others.

The unfortunate thing that's happened is when each of us thought we had it figured out, because it kind of made sense, when you tracked it, you found that you kept getting surprised. The things the leading indicators pointed to didn't turn bad and other things turned bad that you weren't expecting.

A couple of years ago we had INPO up here. And they claimed, at least the gentleman who was representing them, that they had developed a new leading indicator model that really was working and gave short term and longer term predictions that were coming out true.

I wonder if the staff is aware of what was going on there and if that's actually come to fruition at all. And I also like the idea, as Dick put out, of things you might look at, because I think some of those nobody has really looked at yet. That's all.

MR. BOWMAN: Yeah, and this is Greg Bowman. I'm not aware of the INPO, what INPO's, what they've been working on or whether it's come to fruition or not.

We do try to keep a healthy amount of separation between our oversight program and what INPO does just to avoid -- you know, they obviously have different objectives than we do. And we try to keep them separate. But, yeah, so I'm not aware of where INPO is with their process.

CHAIRMAN CORRADINI: Dennis, can I just follow up? Dennis, was it an open discussion or was it a closed discussion? I remember it. But I can't remember much about it.

MEMBER BLEY: I think our whole meeting with INPO was closed.

CHAIRMAN CORRADINI: Okay.

MEMBER BLEY: And it followed on the heels of Fukushima.

CHAIRMAN CORRADINI: Okay. Thank you.

MR. HIPSCHMAN: One comment regarding INPO, and I'll finish my answer on the other one, is with respect to INPO evaluations, we do have a memorandum of understanding with them.

And one of the things that the NRC inspectors have access to is their evaluation report. And inspectors will typically read that just to make sure that they haven't missed anything, verify, you know, their conclusions as far as licensee performance. And if there's any new insights that inspectors need to follow up, they will leverage those reports as needed.

With regard to the 95003s, I am not aware of anything as Greg mentioned. However, we do have sort of a lagging indicator, to some respects, is that we do look at the 95003s after they're completed.

We do a lessons learned report, which tends to be rather extensive. There are several corrective actions that are generated from each lessons learned report that the staff follows up on to look to see how inspection procedures, manual chapters can be changed. But I don't think we've done anything that kind of looks at all of them in the whole.

MEMBER SKILLMAN: I would sure like to encourage finding a way perhaps to take the 95003 conclusions and seeing if there are not commonalities among all of those 95003 inspection, the completed reports, because I have a pretty strong sense that there are diamonds down in there.

MR. BOWMAN: That's the first suggestion we'll --

MR. HIPSCHMAN: Yeah.

MR. BOWMAN: -- think about.

MR. HIPSCHMAN: Yeah, I think it's interesting --

MEMBER SKILLMAN: Thank you. Please proceed.

MR. HIPSCHMAN: Next slide, please. A related point is other areas where we can adjust our inspection program for plants is for plants that are experiencing financial issues. We do have guidance for that for various things to, inspector to look at such as challenges to material conditions. And you'll see four plants that have been in that. And the inspectors will comment in the inspection report.

Also, we do have guidance for plants that are nearing cessation of permanent operations. We'll adjust, the inspectors will adjust their inspection areas such as, you know, they'll look for is there an increased attrition of, say perhaps, licensed operator, are there any changes in material condition.

And so they'll look at those kind of things. And as appropriate, they'll follow up on the baseline inspection program for areas that might warrant that.

And the other things that we have as tools are safety culture initiatives. As part of our biannual problem identification and resolution inspections, we have a part of that that looks at safety culture. And also in our 95002 and 95003 we have much more extensive guidance regarding looking at safety culture.

Let's see. Also, we do have other inspection procedures in manual chapters such that during plant walkdowns or senior manager site visits we do look at material conditions. We do look at long-standing issues. We do highlight those, bring those up with licensee management.

And again, you know, overall the ROP is a very flexible inspection program. Inspectors have a lot of flexibility within the program to look at various things, use modules to look at degraded material condition, look at human performance, look at problem identification. And they can review and report those as appropriate.

Again, in the action matrix, one of the aspects of that is increased management presence, as well as a site we'll go through the action matrix or increase in the action matrix. Not only is there increased management presence, but there's also increased management review, such as with the inspection reports and things like that and public meetings.

With that, I'll -- if there's not any more questions, I'll turn it over to Greg.

MR. BOWMAN: Okay. So, on the next slide, so, at the very beginning of his presentation, Tom talked about the self-assessment process.

So the ROP is a mature program. It's been in place for about 20 years. One of the key components of the ROP is self-reflection, figuring out things, you know, on a periodic basis that we could have done differently, could have done better to improve the program.

So the beginning of this slide, the first main bullet and the sub-bullets on this slide talk about some of the ongoing initiatives we have to make the ROP better.

You know, we've had a lot of work on the inspection report development process. We've streamlined our inspection reports. And we're nearing the end of an initiative to automate the production of our inspection reports to make it easier for our inspectors so they can be focusing on inspection and not inspection report writing.

Dick, when you presented, you talked about the four levels of violations. There's a fifth down there that we, that gets, that results in a lot of work but doesn't, you know, see often. Those are minor violations, right.

So, if you have a -- you don't fill out a -- or you're working through a procedure and you don't follow every step, but there's no impact from failing to follow that step, we'd often characterize those as minor violations.

And Tom and I being inspectors can tell you that we spend a lot of time with our management discussing, and I'm using discussing gently, that's a gentle term for what we wind up doing, with our managers about whether an issue is minor or more than minor.

So we have work going on to sort of help give better guidance to our inspectors so they don't have to deal with the, all the back and forth. Things are more clear to them on what's minor and what's not.

MEMBER SKILLMAN: Greg, thank you for that clarification. That was an oversight --

MEMBER BLEY: Can I --

MEMBER SKILLMAN: -- on my part. Thank you.

MEMBER BLEY: May I sneak in a question here?

MEMBER SKILLMAN: Please, go ahead, Dennis.

MEMBER BLEY: You know, from an overall plant safety point of view, that seems to make sense. From a human performance point of view, if it's the same action that could have created a serious problem, you really ought to look at it.

MR. BOWMAN: Yeah, and that's a function of how our program is set up. We look at, we essentially look at what the consequence was of an issue.

There's often times cases where, if a circumstance was slightly different, then the violation or the finding would be of greater significance. And that's sort of a fundamental part of how our program works.

I think one way we get to that issue is through our cross-cutting issue program where we, you know, when we go through, we have a green finding. We figure out what the causal factors are. And we look to aggregate, you know, see if there's a trend in an area.

But that's a fair point. And it's sort of just a fundamental part of how our program works.

One thing I would add is that, you know, on a biannual basis we do a problem identification and resolution inspection. And that inspection procedure allows us to dig in a little more deeply on issues that are less, that are minor.

So we can do -- we do some trending. We document observations that normally wouldn't be documented because of the low significance of the issue.

MR. HIPSCHMAN: You know, notwithstanding that, in my experience at the sites that I have been at is that when the inspectors provide comments that aren't more than minor or their observations, the licensees treat those very seriously. They put those in the corrective action program. And they do take action.

And also, the inspectors have the opportunity to follow up those that -- you know, they'll keep those in mind. And if they start aggregating and they look for a bigger programmatic type deficiency or trend, the opportunity is also to have an opportunity to make a finding or violation from that.

MEMBER SKILLMAN: Yeah, Dennis, to your point, my experience, my firsthand experience is very commonly the minors or the debate about more than minor normally falls to the director of operations or whoever is running engineering, because it's either a procedure failure, a failure to perform procedure properly or it's a Criterion III design issue.

And the amount -- debate is the right word, but perhaps not politically correct. But the amount of energy in discussing whether it's minor or more than minor, at least in my view, addresses, Dennis, your comment. Could there be something that is very subtle whose impact is not fully appreciated?

And in the multiple events I've been involved in, the extent of discussion and the tone of the discussion has been very effective in sorting out whether or not the minor issue was truly minor or whether it was more than minor and could have been leading to a more subtle or more serious outcome. And those debates --

MEMBER BLEY: Well, what --

MEMBER SKILLMAN: -- have been very, very --

MEMBER BLEY: What --

MEMBER SKILLMAN: -- very spirited.

MEMBER BLEY: What you say and what the other fellows just said is encouraging. But the idea that Joe just got lucky and Harry gets nailed to the wall because he wasn't lucky is a significant thing to worry about.

MR. BOWMAN: And one thing I just wanted -- this is Greg again. One thing I wanted to just amplify something Tom said. So, regardless of whether a violation is minor or more than minor, the licensee still needs to fix it. They need to put it in a corrective action program.

And if you have a case where there was a near miss, we would expect the licensee's corrective action program to include a robust causal analysis, you know, in-depth corrective actions. And as Tom mentioned, we can go back and inspect those even if they were minor, even if it was a minor issue.

MR. HIPSCHMAN: You know, and one of the things --

MEMBER BLEY: Okay.

MR. HIPSCHMAN: -- in assessing whether it's minor or not, there are several questions that the inspectors have at their use. And one of those is if that issue was left uncorrected, could it be a precursor to a more significant event. And if it is, then it would be kicked up into more than minor.

MEMBER BLEY: Okay. And since you used the word precursor, the precursor program looks at events and then says from this point on could this have become serious. And it seems like that kind of thinking, from what you're saying, is getting picked up. So I think that's very important.

MR. HIPSCHMAN: Thanks.

MR. BOWMAN: So then the next, you know, sort of sub-bullet on this slide is the work we've been doing over the past couple years to improve the engineering inspection program. I believe we briefed you on that. And we're getting close to the point of sending a paper up to the Commission with recommendations to make the program better.

So I mentioned at the beginning, you know, we established this transformation team at the NRC probably I guess it's been about a year ago now. That sort of kicked off a lot of input coming in our direction.

The transformation team was largely focused on making the NRC more agile, more able to deal with new technologies, that kind of thing. But they went out and solicited stakeholder input on pretty much anything the NRC could do to be better.

A number of those recommendations were related to the ROP. Because it wasn't really within the transformation team's charter, they just essentially passed those recommendations on to my group to review.

You know, sort of coincident with that or in conjunction with that, we got feedback from the industry, from NEI, and from NRU, the National -- I'm going to forget the acronym.

MR. HIPSCHMAN: Regional Utility --

MR. BOWMAN: Group.

MR. HIPSCHMAN: -- or Users Group.

MR. BOWMAN: With additional proposals from them on how to enhance the ROP.

And then we just recently got a follow-up letter from NEI with sort of a consolidated list of recommendations from the industry on what we could, what they believe we should change in the ROP.

So, on the next couple slides, I'll go through just at a high level what some of that feedback was.

So the input from the transformation team, I mentioned there were about 70 recommendations, fit into generally these categories. And it was, you know, it was raw, sort of unfiltered feedback from the staff. So, you know, often there were recommendations that conflicted with one another or, you know, some of them were not very well developed.

But, you know, probably the most common recommendation had to do with the structure of the regions, you know, whether the resident inspector program, whether that should be expanded or done away with, whether our Division of Reactor Safety and Division of Reactor Projects should be organized differently. We got a lot of suggestions in that area.

And then again, you know, pretty much every component of the ROP inspections, PI, performance indicators assessment, and SDP, we got some suggestions.

And so we have all those recommendations in. We've done some binning, you know, to group them together. But that's the extent of what we've done to date. Next slide, please.

So the -- we got a letter from the industry, from NEI, on the 19th of September, so just a week ago, a little over a week ago. And then we had a public meeting with NEI the following day for them to brief us on their recommendations.

The one thing that I think we've heard from both industry and from other stakeholders is that the ROP is a sound oversight program. You know, it's one that countries around the world model. And it's not one that I think any of us argue should be substantially changed. So, however, I think we all acknowledge, both the staff, industry, other external stakeholders, that there are areas we can improve.

So this slide provides sort of a synopsis of what the industry's recommendations were. And they really fit into four areas.

Impact of white findings, and so that would be things like do we issue a press release for a white finding or do we not issue a press release, how do we communicate the relative risk of a finding.

You know, a white finding is low to, we characterize it as a low to moderate risk. Is that really what a white finding is? And when we're in the minus 6 range for a finding like that, is that an appropriate characterization? Does the public understand what we're saying when we say low to moderate? So that type of thing.

And then we got feedback also on the type of inspection we do to follow up on a white finding. As, Dick, you mentioned, we do a 95001 inspection, which, you know, it's the lowest of the 9500X inspections, but it's a fairly intensive effort. And so does that make sense given the low safety significance of a white finding?

We also got feedback from NEI on the baseline inspection program, whether it's where it should be. You know, one of their suggestions was take a look at licensee performance over the last several years. If a plant has been in column 1 or has been doing well based on whatever indicators we come up with, could they get something less than the baseline inspection program?

MEMBER SKILLMAN: I would like to just jump in here because --

MR. BOWMAN: Go ahead.

MEMBER SKILLMAN: -- I think that is where, if one were to take a 95003 lessons learned and refine them into action statement and then look at the baseline inspection program, one might say, one might conclude or assert that licensees that are performing excellently against those 95003 --

MR. BOWMAN: Criteria.

MEMBER SKILLMAN: -- items could almost be exonerated from some level of inspection because their behavior is so opposite to what the findings are in the 95003 category.

In other words, the work management program is bulletproof. The connection from the work management program to the root causes is remarkable. I mean, they really do root causes. They go right down to the last nut and bolt. And by and large, they are on target. Their recordkeeping, their MT&E is right where it needs to be.

You could almost say a plant that has that type of performance and also has a safety culture that is thoroughly positive, one might say we can probably back off. So what I'm suggesting is there's a connection between that question and lessons learned out of those 95003 inspections.

MR. BOWMAN: Yeah, that's exactly what I meant when I said we would, this would be something we would look at as part of this.

I think, you know, the inspection program and the performance indicator program are meant to be complementary, right. You have performance indicators, and then you have the things that can't be readily measured by a performance indicator we go out and inspect.

If we were theoretically able to identify a better set of performance indicators that could result in need for less inspection, but, you know, we just started with this so I don't want to --

MEMBER SKILLMAN: Yep.

MR. BOWMAN: -- you know, predict where we're going to end with it.

MEMBER SKILLMAN: I'm agreeing, I guess in a way agreeing or maybe even championing a real serious look at this because it might be to everyone's benefit. What it really does is it might make resources available to do other really important stuff.

MR. BOWMAN: Right, right. Similarly, this doesn't really fit into the inspection program cleanly, but industry had some suggestions on the mitigating systems performance indicator and specifically whether that indicator is really needed anymore, whether it's -- you know, we don't have very many -- I think it's very rare for us to have a greater-than-green MSPI.

And most licensees, you know, when the program was put in place, many of them took actions to make those systems less risk significant. You know, they made modifications to the plant.

So the value, one could argue that the value of the indicator has gone away somewhat. It's very complicated to calculate. It's not easy to understand necessarily for the public. So the feedback was, you know, what's -- I think whether we could do things better with that indicator.

They had suggestions on improving the SDP, some specific SDPs that they suggested we go back and look at, and then some sort of infrastructure work to -- you know, we have a lot of interaction with licensees as we're completing a significance determination process for potentially greater-than-green finding.

A lot of that is around the assumptions that go into the SDP, things like recovery credit, common cause failure. Those things result in a lot of discussion. And so the recommendation was really can we establish better ground rules up front so that NRC and industry both know what sort of assumptions are going to go into an analysis.

And then they had, the last, you know, sub-bullet there, some feedback on resolution of inspection issues. So, and some of this is addressed by our backfit initiative.

But is there a way we can more easily resolve low risk compliance issues, things that -- you know, we have an inspection finding. We know based on a PRA that the finding is very low risk. But sometimes we can spend a lot of effort trying to get that resolved. Sometimes there's action statements that require the plant to shut down. And is that really where we need to be based on the risk of the finding? So that's sort of the fourth item. So next slide.

So we are in the very early stages of working through all these recommendations. As I mentioned, the letter from NEI just came in a week and a half ago. We've done some work to sort of bin all the recommendations between what we got from internal stakeholders and from the industry.

And what we're planning on doing is setting up some working groups internal to the NRC to go through and evaluate the proposals. We had a kickoff meeting with our team. October 3rd was yesterday. So it was just yesterday.

And then we already -- we meet with the industry on a monthly basis to go over items of interest. We'll be using those meetings to sort of engage with both the industry and stakeholders on their proposals, talk through them with our next meeting scheduled for the 18th of October.

We do -- some of the recommendations we

got, many of them actually, are fairly significant, you know, either fairly significant from an evaluation standpoint or fairly significant when it comes to implementation. And many of them would likely require Commission approval if we were to choose to adopt them. And that process is laid out in that management directive, the criteria for when we go to the Commission versus when we can make changes on our own.

And then I guess I didn't put this on the slide. But obviously, the big changes, we would need to engage with ACRS to get your feedback before we went to the Commission with any sort of proposals.

MR. HIPSCHMAN: You know, Greg, also with a Commission meeting, recently operating reactor business line --

MR. BOWMAN: Right.

MR. HIPSCHMAN: -- it was a topic during the Commission meeting. And the Commission pretty much encouraged us, you know, take a look at these, consider your path forward.

MR. BOWMAN: So that was all we had. Let's open it up for questions now if you --

MEMBER SKILLMAN: Greg and Tom, thank you very much. Colleagues, what Greg and Tom are showing here is, first of all, it's a heck of a lot better than SOLP.

PARTICIPANT: I can agree with that.

MEMBER SKILLMAN: For those who weren't around, that was the Systematic Assessment of Licensee Performance, and the ROP replaced that. And this is much more objective and much more thorough. I would say much more flexible, and it's not personal. So this has been a huge enhancement at least from my perspective.

And I would just like to keep thinking about are there some tools readily available that will help our industry colleagues and help the staff maybe shape forward-looking activities that might result in optimization of resources for everybody.

So thank you. Colleagues, any questions for Greg or for Tom?

(Off mic comments.)

MEMBER SKILLMAN: On the phone line, is there anybody out there that would like to simply say hello so we know you're there? Anybody in the room?

MR. BOWMAN: I think there's a comment.

MEMBER SKILLMAN: Great. Sir, good morning.

MR. THORPE: Good morning. John Thorpe with Office of the Inspector General. I'm their

Senior Technical Adviser. I'm a former Chief of the Operating Experience Branch.

I've heard some discussion earlier regarding the initiatives that INPO might be taking relative to leading indicators and evaluating what they can do to get a better pulse on what's happening with their plants.

And I would recommend that you guys talk to the Operating Experience Branch. They have a routine. It's once or twice a year. I don't think they've stopped it since I was the Branch Chief. They meet with INPO. They do a compare notes kind of session.

And I know for sure that in one of the meetings that I sat in on we had INPO staff talk to us about the leading performance indicators, the leading indicators that they were trying to develop from their perspective as INPO.

Now, obviously, they're shooting for different goals and thresholds. But they're also really trying hard to try to find out what it is that they can sense from all the data that comes in, from EPIX, from all these other things. How can we sense whether somebody's on the decline or are they improving or remaining the same?

So I think there's some valuable information that may be available to you from the Operating Experience Branch and just wanted to offer that to you.

MEMBER SKILLMAN: Mr. Thorpe, thank you. Thank you.

Before we come to close here, I want to thank Derek for his effort to put this together. About 24 sets of reports that I've been studying and that Derek's been studying are the basis for the first presentation. So, Derek, thank you for your effort.

Colleagues, any questions for me or for Greg or for Tom, please? Hearing none, Mr. Chairman, back to you, sir.

CHAIRMAN CORRADINI: Okay. Thank you very much to the staff. That clock does not work. Just so we're all clear, it's still not -- we haven't -- we're not like an airplane that arrived five years later or whatever the hell that is.

PARTICIPANT: It's an hour behind right now.

PARTICIPANT: It's actually adjusting itself.

PARTICIPANT: It stopped.

CHAIRMAN CORRADINI: Yeah, I think it's

dead. It's dead.

(Off mic comments.)

CHAIRMAN CORRADINI: So thanks to the staff. Appreciate it. And we're going to go into a lunch break and be back at 1:00.

At 1:00 we're going to do the quality review for the research topics of interest. And Dr. Rempe will, Member Rempe will lead us through. Okay? Thank you.

(Whereupon, the above-entitled matter went off the record at 11:47 a.m. and resumed at 1:00 p.m.)

CHAIRMAN CORRADINI: So we'll start again with the quality review. And, Dennis, I think you're the first one up as chairman of the team and Joy will take over.

MEMBER REMPE: Okay. Just before you start though I want to remind everyone we're going to have two of these.

And as we go through this, think about to the two chairs, Margaret and Dennis, how soon you can turn around the input for the actual document because that's a question we need to think about in when we're going to issue the letter. So go for it, Dennis.

MEMBER BLEY: Okay, thank you. On the

title slide I remind everybody our team was myself and Walt and Dick. Are we still on the record or is that done?

CHAIRMAN CORRADINI: We're still on the record.

MEMBER BLEY: Okay. So we'll have notes from this. That's good because I don't think I can take them. Okay, second slide is the PIRT project description high energy arc fault.

And it's been on the NRC's table for a while. But some things happened in the last few years that have changed their thinking a bit. These arc faults seem to be, not seem to be, have been more prevalent than people thought in the past.

Very severe arc events often involve unanticipated break or coordination failure. Things that you wouldn't normally know weren't properly aligned if it was very high past current then they don't work the way people expect them and that causes multiple problems.

The existing models they have developed did not comport with experiments that the staff sponsored. And you all saw the aluminum bus fire and enclosure fire, hello.

CHAIRMAN CORRADINI: Yes, we're still

here, Dennis. We can hear you.

MEMBER REMPE: If anyone is out on the webcast please put your phones on mute, okay.

MEMBER BLEY: I am hearing a reprise of Mike's introduction that's very loud.

CHAIRMAN CORRADINI: I think, Dennis, there seems to be a delay with the webcast so if you --

MEMBER BLEY: Well there always is. But before I did not hear it over my phone and now it's really, I'm hearing 50 seconds behind and it's really confusing.

CHAIRMAN CORRADINI: I understand.

MEMBER BLEY: So if they can cut down that crosstalk it would be great. But I'll go ahead.

CHAIRMAN CORRADINI: Okay.

MEMBER BLEY: And try to put that out of my mind.

CHAIRMAN CORRADINI: I can even hear myself.

MEMBER BLEY: Well once they ran into that problem with the aluminum and other issues that kind of surprised them they thought maybe doing a PIRT that helped them set priorities for further research.

MEMBER REMPE: Dennis.

MEMBER BLEY: The report --

MEMBER REMPE: The webcast is coming through perhaps your system. Can you put your system of the webcast on mute because we are hearing you through the phone line, okay.

MEMBER BLEY: I didn't hear it because I had the headset on.

MR. BROWN: Dennis, you can't have the webcast going at the same time you're speaking because it's a ten minute, ten second delay.

MEMBER BLEY: It's actually a 50 second delay.

MR. BROWN: It's a delay so you can't have --

MEMBER BLEY: I didn't know my speaker --

MR. BROWN: You can't have both on.

MEMBER BLEY: I didn't know my speaker was on because I had these headphones on. This should be better now.

MEMBER REMPE: Thank you.

MEMBER BLEY: We found that the PIRT exercise was conducted in a reasonably satisfactory way to frame the financial risk contribution in nuclear power plants from these events. And they also tried to evaluate their own state of knowledge when they did the PIRT which is a smart thing to do.

Next slide, documentation, clarity of presentation. Our consensus score was a five. I'm going to take a little diversion because of the conversation that went on in the last couple weeks.

We did this kind of the way I've been on three or four of these, kind of the way we've, I've always done it. But others have said, gee, the way we did this if one person is an outlier we just make them, talk them into changing their score so they're all about the same.

Well we didn't do that. We followed what you do on elicitation. And if we were diverse and on a few things we had scores as wide as, whoever is moving the paper is driving me nuts.

We had things as diverse as an eight and a four or a three. So instead of saying let's come together we talked about why each of us had the scores we had.

And when you do that you find out we were looking at slightly different things. And some things, I don't know if you've played with this scale much, some you could put in multiple places.

And some of us would put one issue under clarity of presentation where the other person might put it under uncertainty. So we reached agreement on where everything belonged and exactly what questions we were trying to answer.

And then independently still, we reevaluated, boy, that sound keeps coming in. We reevaluated our individual scores and you'll see those at the end of the presentation.

After that point we had a final discussion following the ideas that are in the Shack report saying let's come to a consensus on the score that we think represents kind of the best knowledge of technical people in this area. So we treated our scoring like a properly done elicitation that was facilitated and I did the facilitation. Let's go ahead then.

MEMBER REMPE: Dennis, do you want to point out to everybody on Slide 9 that you do have the individual scores too just as they go through this?

MEMBER BLEY: I was going to do that when I got to Slide 9, but you pointed it out.

MEMBER REMPE: Okay, thanks.

MEMBER BLEY: We had slightly different scores on this to begin with. When you start reading the report it's very good. But then it turns out that really three of the chapters, 1, 2 and 4 are really well written, clear and precise.

Chapter 2 provides a really good description of the PIRT process and how it ought to work and including the things that would affect uncertainty and helping identify important factors.

Chapter 4 was pretty tight and ordered on the presentation of results, but at a high level. They didn't dig into the details of the ordering out at that point.

If you read Chapter 3 which is kind of the results section and you don't know what you're reading. After you read the appendices you know what's in Chapter 3 but you can't really tell it just from Chapter 3.

It's a collection of results and tables with not much to tell you what you're looking at and why it is the way it is. So overall we thought it was pretty good and you'll see later that we think there's enough information you can figure out what's in Chapter 3.

Our individual scores on this one after we had that reconciliation of what we were looking for was a five, six and a seven. But when we talked about it, especially because of the way Chapter 3 is put together, we all agreed we would give it a five.

Next slide which is identification of major assumptions. This is a tough one and Joy pointed out, you know, there are some things we complain about that maybe it shouldn't be a five.

But one of the key things they had to do was figure out what to look at. And they found three generic fault scenarios that were very well documented and provided a reasonable baseline for the PIRT.

The report I thought, well we all thought, clearly and objectively described the assignment of a hierarchy of phenomena and employment of the methodology. They did very good, better than satisfactory on description of the bases of the phenomenon and defending their importance.

There were, however, some unstated assumptions that took this away from being a lot better than good, normal work, good, professional work. They give you the rankings they use but they don't really have, what you ought to do is have a plain English scale that describes what they mean so you're all using them in the same way.

They had an unknown ranking and although it's never explicitly stated the way they put the scores together they essentially treated unknown as if this particular phenomena has no value and that's not right. If it's unknown it could be really important or it might not be.

To treat it as absolutely unimportant is putting a pretty strong bias in the report. This is linked to something you'll see later on facilitating the process.

They have a rank equation and it kind of makes sense. It goes the right way when you put the scores together. But there's really no justification of why it's especially, why it's the right way to put them together.

Excuse me a second. Wow, pardon me. And finally they assume that their three scenarios span the space of high energy arc faults.

Some place later they note that the people on the Panel could have looked to see if there were other things they hadn't looked at. But that should have been, we think, explicitly a part.

So there were some unstated assumptions. But they documented what they did very well and we came out with a five on that one. Our own scores were five, five and seven.

I had a couple notes here. I've already covered those, very good. Next slide is justification of major assumptions. I also had a consensus score of five on this one.

The overall assessment was reasonably good. The authors provided appropriate and useful justification of the assumptions they identified as assumptions.

The identification of the phenomena that they were investigating created a little confusion between cause and effect for us as readers especially one of us. And that's a reasonable thing.

Later they give enough story that you see that they're evaluating both cause and effect issues and it's a reasonable thing to do. But they didn't introduce that as well as they should have.

I already noted the treating of the unknown ranking as having no value is never justified. And it apparently is not recognized. If they're going to get facilitation that should have popped out at us.

The rank equation, so we didn't really hit them too hard on the previous one on these things that were assumptions. But over here under the assumptions expanded it a little bit.

And the other one is one I talked about before, little explanation of why the three scenarios were picked and why that, you know, we ought to think that stands in place. But on the main issues they did and on the assumptions they announced they did a really good job of explaining them.

So there are some things that push well above a five, some things that push below a five. Our scores here were four, five and six with one of us thinking they really did a pretty good job and one thinking not so good and one thinking down the middle.

After we discussed it given where we scored other things related to this we agreed that a five was a reasonable score for this issue. We'll come back to those things that were hidden assumptions later.

Next slide is soundness of technical approach. Here they come out a little better. Our final scores were, this was after we readjusted our individual scores.

We were a four, a six and an eight. So two of us above five, one of us below it. After we had our discussion we kind of centered back on it, they really did a pretty good job but you've got to dig around to find it.

So the first bullet is talking about that. If you take the whole report and you mentally integrate the description of the methodology which is very well done in Chapter 2, the pretty cryptic summary in Chapter 3, the detailed results in the appendices and the conclusion of Chapter 4 you can evaluate the overall soundness of the report.

And we think it's a little better than a good, professional job. The approach used in performing the elicitation from the six experts was sound, well documented and produced a useful product for informing a road map moving forward with HEAF.

We have some caveats on that, that will show up on a later score. There are a number of issues associated with the proper role of the facilitator. We have chosen to evaluate all of these under the following section.

They could fit in other places like here. But we didn't evaluate them here. We grouped them all in that one place and think that was a reasonable thing to do.

I'll take an aside. If you read other PIRTs where you can find some guidance on doing PIRTs you'll find they don't talk much about the facilitator and why that's important.

There's vast literature on how you facilitate things like this, things like expert elicitation. If anybody is interested I can provide you a paper or two or just a nice short summary that links you to the literature.

Much of this goes back to the mid-70s when a lot of these ideas were developed. Even the Shack system when you get into that were very sparse on how to do this facilitation well. And if you don't do it well you open yourself up to problems which we'll discuss in a minute.

The last one results the objectives on uncertainties and sensitivities addressed. Our scores on this after our readjustment that show the individual score was a three, a five and a five. After we had a discussion and thought where this fits within the scope of everything we came up with a consensus score of a three, not as good as it ought to be.

The first one is that they really had a diverse background of people on the Panel who were volunteers from international organizations. Some sent project managers. Some sent technical experts, but it was a mix.

But it's got a nice diverse background for gaining different perspectives and addressing and ranking important aspects of the three scenarios they evaluated. This could have enabled uncertainties and sensitivity to be well identified as Chapter 2 indicated they ought to do and addressed quite objectively.

On the other hand, the diversity of the experts working essentially independently with the same data, the good thing about that is you don't get a group think and this form of elicitation is effective because it enables objective assessment that accounts for uncertainties and sensitivity.

When you get to how things are facilitated however, you really want to bring the group back together and understand why independently they came up with what they did and if there are places where sharing information might be very helpful. In fact, there are a lot of clues in the results that indicate places they really should have delved into.

We, our little group, questioned the completeness of the three scenarios which were derived from actual events and say are there other possibilities that are not covered here. And there could be.

You can invent some if you think through this thing. There's a little bit on the other side. There were, I'll save that until we get to the next one.

This is a continuation. This one

especially bothered me. The evidence of facilitation that, is that could be is pretty strong. Chapter 2 I think fairly thoroughly addresses this.

We all agreed on this. But it appears that no one forced the experts to identify the uncertainty in their own evaluations. It was also not clear how the experts were advised and they were advised to base their importance ranking on risk.

But if you're not a risk an analyst and haven't done a lot of study they should have given you some guidance on how to do that well. They may have done it informally. But not even a hint of it shows up in the report.

Chapter 2 gives a hint about how to seek consensus. But there's no discussion of consensus building. In cases where rankings span the full range and this happened quite often, I forget what their scale is.

But say it was one to five. On the same elicitation one person has a five, another had a one. They just leave it that way and use it. But that's a real hint, as I said, we found out in our own that they're evaluating different things.

The facilitator should have taken those and said, okay, each of you explain why you give it the score you did and when you go through that process you see you're doing things differently. You're looking at different aspects of this issue.

Sometimes the right thing to do is say there are two different things here. Let's break this into two separate elicitations. And you usually find that then you come much closer together.

Sometimes you would find that one person had access to information that not everyone had access to and when you share that you do better. The facilitator ought to dig into this stuff when it looks funny and help seek resolution.

There was another area where they, on a few issues said we don't know enough and didn't make the recommendation. The facilitator could really help with that pushing on what you do know, what you don't know, do we need some outside expertise to come in and help you with it.

And that sort of thing wasn't done. Here's our final summary. Now remember, the scores you see under the three of us were after we had first decided how we needed to evaluate each of the points that we judged and these scores are much closer together than our original scores were because we were evaluating the same thing.

We didn't just do arithmetic on these because there is a serious problem with just doing arithmetic on these kind of scores. And these are fairly close together so it's not as big a problem.

But if you have a very high outlier and you do an average, a mean value the high outlier drives the answer. You can play with some numbers and see that.

And then you say well instead of that let's do a geometric average. Well, if you did the geometric average that kind of takes care of the high outlier but now the low outlier drives the show.

And if you play with that you'll see that's true too. We come together and discussed these and say we think a reasonable place the community would come together on this is the clarity of presentation of five.

After we get all our scores we go through and do the weighting as indicated in the methodology and we come up with a final score. So that's our whole story.

We have to write text around it. I am still a little slow and bleary so I am not sure I will get that done in October. There's a good chance I will.

If I don't we'll certainly be able to resolve this in November and pull it together. My expectation is I'll be with you folks in person in November. But that still remains to be seen.

I've got a lot of things to go through before they say, yes, hop on an airplane, go back there. That's all I have to say.

MEMBER REMPE: Thank you, Dennis. Do any of the Members have any comments or, about the ranking and the information that Dennis has presented here?

So actually since, did you want to say anything to add to what Dennis has presented?

MEMBER SKILLMAN: No. I support Dennis. I looked at the slides, you know, he sent them out for comments and Walt and I got back to Dennis and I'm comfortable with Dennis' explanation of what we've done.

MEMBER BLEY: Walt agreed with that as well. I mean the slides come from our discussion, pretty much straight from the discussion onto the paper.

MEMBER REMPE: So I have one comment. And again, it's just, when I looked at the report and what I was thinking about. And it's not, some of your comments are actually just general guidance that I think is useful for PIRTs in general.

And so I guess that's a comment, why I'm giving this comment is that with respect to unstated assumptions about the usefulness for the PIRT for future research because the report actually, although maybe it wasn't a stated assumption, they did go through and talk about some of the limitations of the information that they extracted from this PIRT, like country specific influences.

And I think that again they took care of it in this document. But it might be something worth highlighting in your text or something along that line is why I'm bringing up that discussion because right now we're hearing that the accident tolerant fuel program will be soliciting and performing PIRTs to guide that research.

And so I think any thoughts we have that are generally good thoughts or guidance on PIRTs could be documented here too. Any thoughts about that, Dennis or Dick?

MEMBER BLEY: Well it's, I kind of like the idea of the country specific stuff. And I will try to read some of that in. I'm a little unsure of us giving guidance in a review of the research report.

If we want to maybe we ought to do a

separate letter that says, you know, there are some things that are missing in general in this PIRT process as implemented by some people. Now I think if you read their Chapter 2 all of these things that I'm talking about should have been done.

But it wasn't explicitly covered on some things. So it, we can put a little outline of that. We can put a little outline of what the facilitation would be.

It seems like the wrong place. But I'm not sure of that.

MEMBER REMPE: Well actually another point they raised is sometimes when they do a PIRT the cost of getting the data influences how the experts weigh the importance of certain data. If they know it costs a lot they basically didn't rank it very highly even though it might be important to have.

And so some of those insights I thought were good insights. And so I'd like to see it somewhere in your write-up. But it's up to you on what you guys want to do. Any other comments?

MEMBER BLEY: I don't quite remember that one. I have to go back and try to find that.

MEMBER REMPE: Yes, I thought it was kind of an interesting nugget.

MEMBER BLEY: I don't remember they said it cost too much so we shouldn't think about it.

MEMBER REMPE: They said it was like an underlying influence on how the experts, I'm pretty sure I saw that somewhere in the report because I think that might be a true statement just in general about person, it's a limitation that they noticed.

MEMBER BLEY: I'm going to have to go find that because that's a, that's really, you know, this shouldn't be a cost thing. This ought to be saying for what's important here's what you ought to do then.

Then a manager says well, that costs too much, I can't do that even though it would be very important to us. But it shouldn't affect the scores they give them. And I missed that if that's in there.

MEMBER REMPE: Well I don't think they encouraged people to do that. They just observed that it was an underlying factor that influences experts. And so I'll try to find that, the actual quote and send it to you. But I thought it was --

MEMBER BLEY: That would be helpful. And it might show up in the place I was talking about where they said we didn't have the expertise to address this issue.

And I think that falls, can be included

under discussion of what good facilitation for this kind of process would be which is missing from many of the lists of advice for doing this, for doing elicitation, et cetera.

MEMBER REMPE: So my notes indicate --

MEMBER BLEY: If you can find that I'd like to highlight it and I can, I know I can link it to the, we didn't have the right experts here issue.

MEMBER REMPE: My notes indicate it was in Chapter 4. But I'll find the exact location for you.

MEMBER BLEY: Thanks.

MEMBER REMPE: If there's no other comments from anybody.

MEMBER SUNSERI: I had one question really for the group. Can someone remind me what the scoring scale is? I mean a five represents good, sound, technical work. Is that right?

MEMBER BLEY: That is correct.

MEMBER SUNSERI: So the overall assessment of this Working Group is that this product is a sound technical product but has some room for improvement based on the recommendations you're making.

PARTICIPANT: That is correct.

MEMBER BLEY: It would be, it's useful for going ahead and prioritizing the research. But you could do better, yes.

And, Matt, if you look on the second page of Chapter 2 of our report where our methodology is laid out there's a table that tells you how the scores go from outstanding to unacceptable.

MEMBER REMPE: And Margaret actually included in her --

MEMBER CHU: In my presentation I have a slide on that.

MEMBER REMPE: Page 7.

MEMBER CHU: Yes.

VICE CHAIRMAN RICCARDELLA: This is Pete. I hate to --

MEMBER BLEY: In our report it shows up in Chapter 2. We didn't replicate it.

VICE CHAIRMAN RICCARDELLA: This is Pete. I hate to show my ignorance. But what does PIRT stand for?

MEMBER REMPE: Phenomenon importance ranking.

MEMBER SKILLMAN: Phenomenon identification and ranking table. I was going to just make one comment, Joy, and perhaps this will support what Dennis is doing, has done.

This was not our review of the research.

It was our review of the PIRT process. And so we really had two different bundles of information. One is the data that research has provided including that excellent video of the aluminum bus exploding.

But then we had the documentation of that. And this was a review of the documentation of the PIRT.

MEMBER REMPE: That's what it should be, yes.

VICE CHAIRMAN RICCARDELLA: So we were, if you will, swapping between glasses and binoculars making sure we were keeping clear in our mind which one we were evaluating. And it is the PIRT that we were evaluating.

Now there was abundant, excellent, remarkable data. But as stunning as the data was we were trying to evaluate the PIRT of that data. And at least I found that to be kind of a wrestling contest in my mind.

The other thing that, about what would be in our letter relative to the PIRT, I think Dennis has identified the three or four items regarding uncertainty which when captured will help the next effort for those who would evaluate a PIRT.

But that will be in the record so we can capture it for our letter. So I think the main things that Dennis was trying to capture will be in the transcript.

VICE CHAIRMAN RICCARDELLA: Are the uncertainties relative to the data or to the PIRT?

MEMBER SKILLMAN: To the PIRT, how they handled it.

VICE CHAIRMAN RICCARDELLA: All right.

MEMBER REMPE: So if there's no other comments or questions should we move on to Margaret's group?

MEMBER CHU: Thank you.

MEMBER REMPE: Thank you, Dennis, and to his team and to Walt and Dick also.

MEMBER CHU: We'll move on to the second review project. We have a review panel of three; Jose, Vesna and myself. And then the research project title is correlation of seismic performance in similar structures, systems and components.

It's NUREG CR-7237, next please. I'll give you a little background. When an earthquake occurs near a nuclear power plant it subjects all the SSCs to ground motions and it depends on the level of the ground motion one or more failure of SSCs could occur.

So the Seismic Probabilistic Risk Analysis requires an estimation of possible correlations among seismic failures of similar components. This correlation is a large area of uncertainty.

And frequently, actually all the time almost, very simple assumptions are made that component failures are either fully coupled or completely uncoupled depending on the design and the relative locations of the SSC in the plant.

So basically as you have two equipments or components that are co-located to each other you assume they are 100 percent dependent on each other. They fail, either they don't fail or fail simultaneously otherwise they are totally independent.

Now this project was actually part of the research office 2010 to 2014 Seismic and Structural Research Plan. And then the project was initiated to determine the impact or correlation assumptions of risk estimate and to recommend a better approach that may reduce uncertainty.

Next please. Now this project consists of four required tasks from the Research Office. The first is the review of SPRA, seismic PRA in literature to understand how people treat correlation and the impact of correlation assumptions on risk estimates.

The second task is review of existing literature on seismic correlation analysis methodology. The third is the review of existing data from earthquake experience and shake table test for their usefulness in the correlation issues.

The fourth one is with the help of experts in a series of workshops, actually there were two workshops, recommend methodology that better addresses correlation issues. Next please.

Before I go to the scoring I just want to briefly summarize what are the results of this project. First one from review of existing seismic PRAs seven categories of SSCs are judged to be more sensitive to correlation assumptions.

I'm going to have another view graph just after this. Now the earthquake data shake table test are found not to be useful for this project.

And from literature reviews of methodologies to treat seismic correlation, the research team identified the Reed-McCann methodology. That's from, I think 1985, also called separation of independent and common variables methodology.

And that is recommended for further research. Next one please. When I say they identify seven categories of SSC that are judged to be important to correlation assumptions what the team did was upon reviewing the seismic PRAs these seven categories were found to first dominate seismic risk contributors.

And secondly, they were judged to have a high degree of a potential correlation because of their numbers within the plant and their typical locations within the plant.

And this is the list of seven things: masonry walls; electrical tanks; mechanical batteries or racks and so on. Next please.

VICE CHAIRMAN RICCARDELLA: Question, Margaret.

MEMBER CHU: Sure.

VICE CHAIRMAN RICCARDELLA: Did they actually look in those PRAs where they had considered full correlation and then did the same analysis with no correlation and, I mean we saw numbers yesterday like 30 percent to 70 percent potential difference?

MEMBER CHU: I think they did.

MEMBER DIMITRIJEVIC: I think my impression is this is not easy to do because I think PRAs are already complex. And just to do sensitivity study like that it would require a lot of manipulation.

So I think whatever they did has to be some simplified way of looking, you know, between the, how was correlation treated. I didn't get the impression how exactly they did.

But they say it's complex and a not easy project. That would be one research project of itself to do sensitivity studies like that especially --

VICE CHAIRMAN RICCARDELLA: Do the people who do PRAs normally do sensitivity studies?

MEMBER DIMITRIJEVIC: The couple I am familiar with tried to do that by doing the scale, you know, the scale correlation factor which is between zero and one. So they can then easily do the zero and one.

It wasn't this basic assumption. That's a little different method. If then they discover strange results they actually, and then spend two weeks trying to understand and didn't really come to, the result was actually you will assume the full correlation with a reduced, the highest CDF it actually produced a lower CDF.

VICE CHAIRMAN RICCARDELLA: Really.

MEMBER DIMITRIJEVIC: And it came out because sometimes in the model when you separate this occur you go into different branches. And when you put this together in correlation it was a very complicated case.

But this can also, it is not necessary that one is more conservative than the other. It often depends on the model of the PRA. But that's my personal experience.

This was not discussed in the report in the task. That's one of our comments you will see that we were not sure there was proof importance of that.

VICE CHAIRMAN RICCARDELLA: So it was basically judgment the factors that they said could affect CDF by this much was basically from judgment not from action?

MEMBER DIMITRIJEVIC: Well looking in that in sequences and concepts, yes. I don't think that was detached sensitivity study. But I'm sure there was technically some. That's my --

MEMBER MARCH-LEUBA: I thought they told us yesterday that the state of the practice was to send it to see the one and see the difference and that's how they got to that 30 to 60 percent. But you're the expert. That's what I thought I heard.

MEMBER DIMITRIJEVIC: Yes. When we had discussion with them.

MEMBER MARCH-LEUBA: That's what I thought I heard, but I'm biased.

MEMBER CHU: I have a feeling there's a lot of judgment in there because they went to, with the experts in the workshop on these. So that made me think it's sort of a, judgmental in many ways, yes.

VICE CHAIRMAN RICCARDELLA: They didn't present any hard data results in the report.

MEMBER CHU: No.

MEMBER DIMITRIJEVIC: And it's not an easy study to do. The model is complex.

MEMBER CHU: Okay. And then the Reed-McCann methodology is the recommended separation of independent and common variables methodology. In this methodology they develop a procedure to estimate dependency between component failures by searching for common sources of variability in the response and strength calculations.

And then the analyst needs to carefully examine the component design and qualification documents, material properties, installation methods, et cetera to make judgment on what are the common variables and then decide what's not.

And so we as a panel feel the methodology could be difficult to implement and it could vary from analyst to analyst because it's such a judgmental cause.

Next one please. Now just to refresh everybody's memory on what those scores mean as Matt requested, five is really the baseline. It's a satisfactory score. It means you have satisfied the research objectives.

And then it goes up and down, you know, from zero to ten and a zero being unacceptable, ten is outstanding. But five is basically a satisfactory score. Next please.

And then these are the individual scores from the three of us. I am number one. Jose is number two. Vesna is number three. You can see that mostly that we're pretty even, okay.

So what we did was basically take an average of the three scores and then everybody agrees is this about right. Sometimes we would round up a little bit, sometimes we round down a little bit, okay.

Next please. And then the five areas of measure, performance measures is, Dennis already went through this. Clarity of presentation, identification of major assumptions, justification of major assumptions, soundness of technical approach, treatment of uncertainty sensitivities.

And then there are predetermined weighting factors for each. You notice that the soundness of technical approach and the results basically is 50 percent of the overall score.

And then with this our consensus final score is five, satisfactory. Next please. I'm going to go through a little bit on each of the performance measures, yes.

The first one, clarity of presentation it gets a six. And we feel the report is very well written and easy to understand. It clearly communicates the purpose, scope and technical approach of the project.

Existing methodologies that deal with correlations clearly presented the rationale for selected methodology is clearly articulated. We did find a few deficiencies in the report writing.

For example, the organization didn't follow the task sequence that was dictated. And then there are also minor problems with the definition of captions in tables or figures.

But overall, we felt it was a good report. So we gave it a six. Next please. Now identification of major assumptions. We kind of struggled a little bit with this one because basically the project, the whole project is a literature review and literature assessment.

So we, you know, so we felt the major assumptions are not clearly identifiable. So we looked through examples of the assumptions discussed in the report, okay.

These are the three big ones. The first one is the correlation assumption is important to risk results and risk insights from seismic PRA. And then the second one is that thumb rule of independence, 100 percent or zero percent that is being used right now is unsatisfactory and needs to be improved.

And the third one is the recommended Reed-McCann methodology would require assumptions on design qualification, installation and so on of SSCs. Next one please.

VICE CHAIRMAN RICCARDELLA: Those were stated as assumptions in the report?

MEMBER CHU: No, they were kind of buried all over. And we kind of identified them.

MEMBER REMPE: It's simpler --

MEMBER MARCH-LEUBA: There is no chapter that says assumptions.

MEMBER REMPE: And I note that's similar

to what Dennis' group had to do too. Both of these projects were a bit difficult and this is the way the group decided to do this rather than eliminate the metrics.

MEMBER CHU: Yes, because it is not the usual research project. You make assumptions and you do this and you do that. So that's the best we could do.

Now as to justification of major assumptions remember the three listed before. We felt there was one that is not rigorously justified in the report which is the correlation assumption is important for the seismic PRA results.

This is a very major assumption. You say is it important or is it not. The report says it is important but we felt it's not rigorously justified. The following bullets are examples of the statement.

These are the statement from the report. It says, for example, correlation assumptions may not significantly impact the seismic PRA results but it could impact the risk insights. But it didn't quite go into what that meant.

And second one for some seismic PRAs the difference in seismic CDF could be as much as almost a factor of two. Typically it was a difference of 30 percent to 60 percent.

And then it says in some SPRAs the dependent failure issues is not as important when the overall seismic CDF is dominated by an accident sequence that itself dominated by a PRA singleton, that means a single failure.

And then it says for some key accident sequences the difference could be as much as a factor of two to four in the frequency of, notice it's the sequence, the frequency of the sequence. So with sort of these vague and all over kind of statements our panel wonders are these factors or percentage changes in the PRA number numerical results significant enough to justify to the time consuming and costly new methodology.

VICE CHAIRMAN RICCARDELLA: Is a factor of two on CDF considered significant? I mean it seems to me that's probably in the uncertainty band.

MEMBER REMPE: But, Pete, they didn't say it was, typically it was more 30 to 60 --

VICE CHAIRMAN RICCARDELLA: Thirty to 60. But even if it were two.

MEMBER DIMITRIJEVIC: It's upper bound for significant.

VICE CHAIRMAN RICCARDELLA: You know, if

it's two it's not.

MEMBER BALLINGER: I read the document like four times and could for the life of me not figure out what the actual uncertainty would be. But I knew it was large.

MEMBER REMPE: Yes.

MEMBER BALLINGER: And so a factor of two compared to PRA results which are sort of like fatigue results is a magnitude one way or the other.

MEMBER CHU: So therefore you notice this one got the lowest score, four, okay. And the next one is the soundness of technical approach and results. And then we feel that the tasks accomplished were defined and then it was done competently.

And then these other tasks that are done as required by the Office of Research and then they did every single one of them, okay. And so overall it's done well with the exception of the previous slide, okay.

Next please, treatment of uncertainties and sensitivities. It gets a five score. We believe the project team has appropriately considered uncertainty and sensitivity.

Some sensitivity analysis were performed. The report addresses how to obtain the uncertainty distribution for the results. In the Reed-McCann methodology the analysts have to deal directly with common variables and their epistemic uncertainty and random variability.

I don't know how to pronounce that word, yes. And since expert judgment is needed in the partition in between the independent and dependent parts the proposed methodology are introduced new model uncertainty, okay.

Next please. Now we have some concluding remarks. I'm going to turn this most important slide to Jose and Vesna.

MEMBER MARCH-LEUBA: Vesna gave me the permission of starting. So there are three conclusions that we arrived at only on the scope.

On the first bullet the name that sticks out is competence. When you read this NUREG you feel the competence of the people that were doing it. And when we interviewed the staff and we tried to obtain more information you really felt that they know what they're doing.

So that has to be stated. This was a competent effort. I'm sure it was the only good thing we can say about the report because it's like point number two says that even though it is a good mathematical method and it will work it's almost impossible to obtain data to apply it because we have difficulty getting the data for the known correlated seismic PRA.

You have such uncertainty. Now you bring uncertainty too into two, one that is correlated and one that's uncorrelated and it's almost impossible to get because all the shaker table experience that, doesn't tell you anything at all because you never shake it to failure.

So they never fail. So you never know how they correlate together. And experience from real life earthquakes has so much variability that you really cannot tell.

So we find that this would be very difficult to implement with accuracy. And actually you would increase the uncertainty of the results.

On point number three is what we've already been discussing over the whole presentation. We questioned whether it is worth, given all the uncertainty that we're going to increase and at best we're going to get a factor of two, more likely 30 to 60 percent.

Is it worth implementing it? And Vesna, you probably can tell us what a factor of two buys you in this one.

MEMBER DIMITRIJEVIC: These factors, numerical values it's, they, I mean obviously the factors of uncertainties and the importance measures in the PRA are not so significant request. But our main impression was when the goals for this project were assessed this report was a pleasure to read.

And I'm very thankful to doubters because they have the good skills. They do a lot. They put a lot in the report.

However, when they defined the goals in the beginning that's exactly what I would want to know, you know, if I was concerned about correlation. Is it important?

And you have a feeling that it should be important, right just like assumptions the components failing the same time or, you know, that it's in the patterns between them. And then to say they're going to look in the data to see can they justify something and then they propose the method.

And if they said in the beginning we're going to look in the different method, give you an overview of that and tell you what we see in the industry and don't set this goal this report would get much higher value because it was our feeling that they did not introduce goal in the way, as Margaret is showing that slide, they didn't really make a statement of how important it is.

When you read what they did you realize yourself but it's not an easy task and it will require much more effort. So they could not really tell us what's the importance of using one co-relationship, whether it's other or not using it at all or, and what would be benefit for this which is very complex and costly method which has to be done with a person who knows fragility very well.

And there is not too many people we bring in to do these tasks. And to be, what is really true that doubters are honest. They didn't overstate it.

They did not tell us, hey, this is important, you have to do it. They did not tell us these assumptions are bad or simple assumptions. They were basically honest.

But they didn't reach their goal because they set this goal very high. If they say listen we look in the literature. We cannot conclude because of blah, blah, blah.

We look in data. We couldn't find the data to support. They said that in the project from the data or from because you always ask, Joy, if there is enough data in industry so that we can conclude something about the co-relationship.

And they say but we present to you a lot of, you know, not a lot but some selection of method and we think that this method has promise. It would be different type of evaluation if that was stated as the goal.

So we couldn't really basically conclude that the data, that anybody would really, you know, want to invest that this report, basically they have a problem that some correlated components dominate the risk. They may want to look into this methodology.

PARTICIPANT: You know, I think the key words are on one of your slides. Slide 12 is the impact risk insights.

And I think that's maybe my opinion about PRA in general is it's not so much, I mean you don't design things based on you've got to get 10^{-7}. But you get some insights, some general insights.

MEMBER DIMITRIJEVIC: Yes, and that's and we were hoping they would provide some examples. I can think myself of some examples of this risk insight would be that you conclude then that, let's say you were like you could measure intake structure.

The intake structure is extremely

important for, you know, the Westinghouse plants. But however, if you have a service for the pumps which are all on the same rotation and the same design that co-relationship between those pumps may be more important than intake structure.

That could be one sort of insight because insights from PRA in identifying important sequences has important components, human actions and things like that. But they never, the only way they mention that is in that one sentence.

It was never explored further in the report.

MEMBER MARCH-LEUBA: I think, Peter, your recommendation, your comment is very wise. And even though when we write the report which Margaret has volunteered to do we maybe, our job is to grade the report.

But maybe we should make a recommendation that it, this methodology would be more valuable applied for insights than for quantitative sharpening of the pencil. We don't think the sharpening of the pencil by itself is worth it.

But the analysis tells you what components you can improve especially for new reactors with multiple modules.

MEMBER SKILLMAN: I want to ask a question here. Jose, you used the, you expressed the comment because the shaker table doesn't take the device to failure we end up, I think, not knowing or a comment like that.

And that is a comment that was also made yesterday afternoon.

MEMBER MARCH-LEUBA: That is correct.

MEMBER SKILLMAN: I'd like to try to flip that at least in challenge. When general design criteria were set out, the revised general design criteria was 1969 and 1970.

In '70, '71 and '72, I bet you would remember this, we were doing seismics. And we were doing square root some of the squares three dimensionally, two horizontal, one vertical.

And Reg. Guide 1.48 was produced and that was active seismic testing. And then came Reg. Guides 1.26 and 1.29 that identified quality classification levels one, two and three and what was seismic one, what was seismic two and seismic three.

And I know for a fact because I was part of it the team at VNW, the team at Westinghouse, the team at combustion and the team at GE we were all the plumbers and we were buying, we were designing and buying basically ECCS and all the auxiliaries.

And scramble became wood shaker table tests are available. And there was one set available at the University of Alabama in Birmingham. There was one set of all of them.

There was a lot of competition to get on those shaker tables. And we shook HPI pumps, 13 stage and 12 stage pumps and we shook heat pumps. And I know Bar W was doing the same thing, combustion was doing the same thing.

And when those shaker table tests concluded for the ground floor response that we put into the shaker tables that if those devices did not fail that was a success. So now and we said fine, so we installed this equipment all over the product line.

Now to say that because it didn't fail on the shaker table sounds to me like fails in correlation, sounds to me it's almost the opposite because it didn't fail on the shaker table what should conclude that remains operable if the earthquake envelope has not been exceeded at that location for that amount.

MEMBER MARCH-LEUBA: The failure of one and all components would be single.

MEMBER SKILLMAN: Let me go further. I

think that same argument is the argument that wins on passive components. And that is your piping and the other robust components that also do not fail on that seismic envelope.

Now so I'm struggling with because it didn't fail on shaker table it's somehow not compliant.

VICE CHAIRMAN RICCARDELLA: No, no, not that it's not compliant. It just didn't give you any information about seismic correlation.

MEMBER SKILLMAN: It gave me a whole lot of information about that component.

VICE CHAIRMAN RICCARDELLA: About that component, yes. But it doesn't tell you whether if you have three other components.

MEMBER RAY: Dick, listen, the issue isn't will it meet the design basis level of shaking. The question is at what point above that does it fail. And then I would tell you as somebody who has run more shaker table tests than everybody here put together that failure isn't a single defined term.

You're talking about the dam foundation failing, you're talking about a breaker within the box failing. What are you talking about failing?

So trying to gather the data and define

what failure you're talking about when there are 20 different ways that something can fail, it's a complex device and we had to do all of our own because we had a two-thirds GE plant, we had to do all of our switch gear, everything is, I just agree with Jose and I'll shut up.

VICE CHAIRMAN RICCARDELLA: You agree?

MEMBER RAY: I agree that trying to get the data that you need through testing, I mean it's different to talk about how the flow and response spectrum is different at different elevations in the building and things like that.

But to talk about using a PRA in which you have failure data to project the likelihood of they're not being a failure at some level of shaking above the design earthquake, which is what you need for a PRA, is to me it's a hopeless enterprise.

MEMBER SKILLMAN: You know, I agree with that. If you're trying to project failure there's never enough data. I agree with that.

VICE CHAIRMAN RICCARDELLA: If, okay, go ahead. You know, you and I have both done a lot of fatigue analysis, right. We computer the cumulative fatigue usage. And so we have a fatigue usage curve or a fatigue design curve data.

MEMBER SKILLMAN: We've got a cuff and we know how to use it.

VICE CHAIRMAN RICCARDELLA: Imagine if when you were setting up this fatigue analysis that you said well my component needs to take, my pipe has to take 400 cycles of this and 50,000 cycles of that. And so I take my test specimen and I sampled it and I tested it for 400 cycles of this and 50,000 cycles of that and said it's fine, you know.

You're not getting any information versus when you take these specimens and you fail them and you see that, wow, you get a huge degree of scatter in the actual failure data from, you know, half a million cycles to five million cycles.

That is information in testing to failure that you don't get by that proof test.

MEMBER SKILLMAN: I agree with that. I certainly agree with that.

VICE CHAIRMAN RICCARDELLA: That's all we're talking about.

MEMBER SKILLMAN: Okay. So we're talking about testing to failure is about, as opposed to testing for competency.

MEMBER DIMITRIJEVIC: Yes, this is a very good moment actually because we can, Harold introduced something which shows seismic PRA complexity when it comes to this. The seismic PRA there is a failure probability for let's say ten.

Usually the seismic intensity is picked in ten intervals. And it is tightened for different ground acceleration rate, the ground acceleration.

In these ten intervals, the last intervals that the components are actually failing are least important from correlation because all the failure probabilities are very high already, .9 or something.

And therefore, the correlation which is not as significant and the frequencies of occurrence of that initial event are very low. And they say this report, the co-relationship is most important in the low or medium range of the seismic where the components are not failing but they may fail.

Probability of that failure can be 10^{-2} or something. And it's not clear what it is. How do you measure for that failure probability because you can only say component didn't fail or it doesn't fail on the shaking table?

The same thing when you have a Fukushima you can go around and check how many components actually failed. But that doesn't tell you anything about failure probability.

Then you have a different failure mode. Will it fail to start? Will it fail to run? It's incredible. You have a ground acceleration, but it's a million combinations. It's very difficult to get from data.

VICE CHAIRMAN RICCARDELLA: If anybody is interested in delving into this in more detail Dennis sent me an old 1988 report and it's kind of like a fundamental, you know, it's a paper on seismic, probabilistic seismic risk analysis.

It's very, very interesting. It's Kennedy and Cornell and some of these guys that were, you know, I could distribute that if people are interested. And it was a lot easier to read than that NUREG. It didn't get into Boolean algebra.

MEMBER SUNSERI: I would like to add some perspective here or a perspective. So those of you who know me I'm not much of a curmudgeon outside of the meeting.

So I just want you to recognize what chair I'm sitting in and think back to past meetings and so my curmudgeon remarks might make more sense. So research, why do we do research?

And the purpose of this review is to provide feedback to the research organization to help them do better research, right? So when I listen to this conversation and I read the report and I think about well research is going to be done to explore an area that we have some unclarity or uncertainty of we're going to isolate.

We're going to research. We're going to review and we're going to elevate the level of understanding of a certain topic so that decision makers can apply that in a way and make better decisions going forward.

That's fundamentally why we do research. So when I see the conclusion that, you know, maybe we have correlated or uncorrelated, it takes a lot of effort, what do we do, is it going to make any difference it causes me to have pause about the value of this research or whether it was really actually research or is this a report on a various topic.

So taking this a little further --

CHAIRMAN CORRADINI: You mean a report in progress versus some strong conclusion?

MEMBER SUNSERI: So I'm going to go back to the statement justification of assumptions which got the lowest score here which it seems to me the whole purpose of this research would have been to identify your assumptions, isolate them and then run a process so that we get a sound technical result that decision makers can use to make better decisions.

So I think the fact that this got high marks for sound technical approach but low marks for justification measures assumptions is a big disconnect. And when we look at the final results I don't think that this "research" is much use to anybody because whether you correlate it or not correlate it, it doesn't make that much difference as the report says.

So I would have given it an overall much lower score, maybe marginal because what, I mean what did it really do from a research perspective? I think that techniques that have been outlined here about starting from a fundamental saying we've got to, you know, there's too much variability in just looking at literature or random earthquakes.

Let's define a specific systematic assessment way to look at correlation, put stuff on shaker tables, use different configurations, use configurations that we know would be fully correlated and shake it.

Use situations that are not correlated, shake it. See what the results are and draw some conclusions like that. So that wasn't done. So therefore I'm not sure, one opinion, what research this accomplished.

MEMBER CHU: But, Matt, you know this has given to them by the Office of Research.

MEMBER SUNSERI: So I'm just telling you --

MEMBER CHU: We kind of --

MEMBER SUNSERI: I don't disagree with that. I'm not going to, and that is a fact. But my point is though that's a bad start right, you know.

So if we're going to give feedback to the research department on how to do better research maybe there needs to be some comment around clarity of that.

MEMBER DIMITRIJEVIC: But, I can see how you come to your conclusion and that could be maybe our failure of how we presented this in the general because we didn't have a chance to talk about it but there are things that we just presented.

We were looking. But I can completely see how you came to this conclusion. But I would disagree with this because of the one point. First, they did not have many seismic PRAs.

Seismic PRAs are just coming with 2.1. And then you suddenly look now in importance of correlation has money and therefore to analyze correlation I am sure they will be able to conclude that co-relationship is important.

Also they used such a primitive actually assumptions which may be good enough or not but we don't know. We just want to say that this report didn't have enough material to conclude for this that, you know, in the general, everybody who is doing that has a feeling there should be something better out of there to do this more scientifically.

As a matter of fact and theoretically pleasing, and it seems to me we'll have a sense. It's simply complex and I am not a fragility expert so I cannot say.

So they are proposing, they do show different methods and they say, industry, that's what is variable. If you have a problem with co-relationship because your dominant card set is correlated you can consider analyzing these methods.

They didn't do any shaker table experiment as that wasn't their job. Their job was to look in results for shaker table results.

CHAIRMAN CORRADINI: But if I might, since I didn't read the report so I'm totally able to do this, I think where he's going with it, it would be I expect this report to say okay, we've now developed a methodology.

This methodology has certain pieces to it. Now of those pieces this is a key piece. Now go do an experiment or go do something because, in other words, what are they proposing to advance it further. I thought that's where --

MEMBER REMPE: Well, okay, so hold on for a minute. A long time ago when we were discussing this because I just review what they presented, the very beginning of the report says they were supposed to find a strong technical basis for a new method is one of their objectives.

And I think as Margaret and the Panel have said today they didn't do that. They didn't give a strong technical basis for what they are suggesting is an approved methodology because they acknowledge there aren't enough data and as Vesna has emphasized it's not clear it's going to make much of an impact.

Now the authors of the report were contractors. They were not the Office of Research, right. And they basically, I think were a little optimistic because they get paid for doing research.

But yesterday, which is not part of our review yesterday and I asked Jose about it. He said, yes, it's something we'll look at if something else comes in. But we've done due diligence in evaluating this possible methodology.

And so I think again, I think maybe research was doing due diligence that this methodology might be better and, yes, okay, the contractors were maybe a little more optimistic. They didn't fully maybe go as far as they could have gone on how, you know, whether this approach should even be considered.

But they're contractors and I don't know if the Office of Research can tell them to change the words in your report and say there's a lot more uncertainty and all that. And that's another issue with when you're doing research as a contractor for the Office of Research. But --

MEMBER SUNSERI: That's fine too and I understand that. But so maybe the, and let me back up a little bit and say not all research has to be, for it to be successful research doesn't have to result in a positive outcome.

You can find it says that the research we did in this area and there are no better ways to do this, right. That could have been the fundamental conclusion.

MEMBER REMPE: It might have been nice.

MEMBER SUNSERI: And that would have been a great outcome, right.

MEMBER REMPE: If the project at the end had said this might be useful. But it does have some caveats in there if you look. It's not in the conclusions as much as I would like to have seen or up front in the abstract.

But they did say, hey, the data are difficult. It's difficult with experts. They did say that. Again, that's a problem about you're dealing with a laboratory where I used to work were doing something that way we would have had trouble if we knew our future bucks hung on that document.

So I mean that's just an issue with the system. But I understand where you're coming from. But I think that, they did do a competent job, a good professional job.

How they presented it, you know, it and I think Margaret, Vesna and Jose are well aware of some of the limitations of the report in how they write it up.

MEMBER SUNSERI: Right. But if you asked your research, you know, if you were, if Ron asked one of his research students to do or they made a proposal to do some research in his lab and they wrote up a great report but it had nothing to do with the topic would he --

MEMBER REMPE: But that's not what they did. They --

MEMBER MARCH-LEUBA: That's not what they did. Let me give you a completely different approach for the same problem. You know, my brain works differently than anyone else's.

The research was given a problem. Let me start by saying first that I agree with you 100 percent. I wanted to give them a two on every single item because I absolutely hate the results of the report.

And that's why I don't know if you remember I spent with you a whole afternoon and Pete was here. We spent six hours just going through the whole methodology through how it is because I even wrote my own Monte Carlo simulation of the problem to get the feeling of how things work.

Then I was convinced that I was looking at the report that they were given a problem and that problem was go do a search of the literature. Don't reinvent the wheel. See what has been done and pick the best that's available.

And that's the way I understood this report to be. I will give the guys that wrote the scope an F. I would give a two to the guys that wrote the scope of the problem.

But once you hear the scope research did the best they could and came up with some bad product because they were given a bad question.

MEMBER SUNSERI: So let me understand. And there was a user need and that was the scope.

MEMBER MARCH-LEUBA: It wasn't user need. It was a research program.

MEMBER REMPE: Part of their seismic.

MEMBER CHU: My perspective is I think Office of Research, they probably had a vague idea, okay, and then they say the correlations should be important. And they say if you do literature search, you do this and that I think they are very optimistic something would come out.

But they knew it was hard. Therefore, they say get experts, field experts in this area and then have a few workshops and ask them to help you. So if you look at the scope it's an optimistic scope, okay.

And then these contractors got the scope and then went, diligently went through this. This is the best they could do. So we, I think we all understood that. I know we discussed many, many times about what does it mean, yes.

And then this is what we came up with because they did everything they were told to do. And then they tried to find all the information. They tried to see data, they could get data, okay. So this is what we got.

MEMBER SUNSERI: And I understand. So let me just respond. And I appreciate the fact that the research organization is going to be asked to do some things that is not purely research, okay.

So the PIRT was another example. I mean a PIRT isn't research, right, it's a process. It's just like okay, you know, go take a given process and apply it to this phenomena and tell me what the outcome is, right?

That's in my judgment not research. But nonetheless.

MEMBER MARCH-LEUBA: And that should be reflected in the report. I think that's what we need to do.

MEMBER SUNSERI: And so maybe in reflection of my feedback here it's back on us that we should be more selective of what projects we select to do our research quality review on to make them more research oriented projects.

CHAIRMAN CORRADINI: I don't think we have that luxury. The Research Office here is an applied research office. And a lot of the things they do are relatively narrow in scope and incremental.

And what I heard Margaret, what I thought I heard Margaret say is this is an incremental work scope that they thought they knew the answer before they were going to do it. They said go forth and do it.

And they come back and it's kind of like, a result. So if you're going to write --

MEMBER BLEY: Can I get a word in?

VICE CHAIRMAN RICCARDELLA: Sure. We didn't even know you were there, Dennis.

MEMBER BLEY: Well I've been yelling for the last 45 minutes. So Ron must have had me cut off. But he's now cut me back in.

I'll try to be very quick and brief. On this last go around I really agree with the idea that these, research that is applied and basic research and the things we looked at today are to me in the applied research area.

And I think they're reasonable. Now to go back to the earlier discussion about how much this correlation can affect the risk assessment, I'm going to take you back to the late 1970s.

One of the references in the report is a Seismic Safety Margins Research Program in Livermore. And those guys did a tremendous amount of work and modeled all sorts of correlation.

And it was quite interesting. But then over the next couple of years PRAs were being done. And some of the things that drove this kind of disappeared.

You know, we were very worried back then that you have all of these segments of piping and if they are 100 percent correlated, you know, we could have some real problems. Well it turns out that all the piping is, I think that's me causing trouble again.

All the piping is very stout. Also the valves we were worried about. So that the issue kind of disappears because you never get up to the levels that take those out.

And on the other hand, some things are very weak. And you go over their threshold whether they're correlated or not.

In the early 80s Kennedy and Cornell wrote a piece that was kind of a sensitivity study on varying the, looking at the correlation in some detail and also using these rules of thumb. And it showed the rules of thumb work pretty well.

Vesna gave a real good discussion of the idea that the real design of the plant is what affects whether correlation is important or not, the real design of the plant and the absolute level of fragility.

For the very low fragility it doesn't matter very much. For the very high fragility you never challenge them whether they're correlated or not. For the stuff in the middle it matters but these rules of thumb have worked pretty well.

So I kind of agree with all of your discussions. And I just wanted to get that historical note in there. We were worried about things that would dramatically swing the results that impact the correlation matter.

And they turned out not to matter because of the details of the fragilities and the design. That's all.

MEMBER REMPE: So we are supposed to be done at 2:30 and I need to let the audience, which is the staff who has come and we've not let them have an opportunity to talk about either project.

And then I would like Margaret to also

weigh in about timing to get her draft done because I assume based on what Dennis has said we're not going to see the draft report until December full committee and I know you're looking forward to another item to put on the agenda in December, right.

CHAIRMAN CORRADINI: It doesn't have to be done in December.

MEMBER REMPE: Okay. I just wanted to make sure because then we might be February. Is February okay?

CHAIRMAN CORRADINI: When is it due, March? We're not in a rush.

MEMBER REMPE: So I wanted to make sure that was okay because I didn't want to --

MR. NOURBAKAHSH: We are not in a rush. We could send it any time.

MEMBER REMPE: Okay. So then if that's the case then let's plan for February and everybody won't worry about it. Staff, you have listened so kindly without jumping up and down.

Do you have any comments about what you've heard today for accuracy that we need to be considering? And tell us which project too just to make sure we understand.

MR. HAMBURGER: Good afternoon. I'm Ken

Hamburger. I'm the author of the PIRT report, NUREG 2218. Briefly just want to say thank you for your comments and your feedback.

This was my first NUREG so I will certainly use this as an opportunity improve the quality of our research products. Two clarifications that I think are worth making.

The first is where a value of unknown or uncertain was given and I said that has no value that's not to say that the phenomenon was not of value, simply that it wasn't given a numerical ranking.

It wasn't including in the arithmetic mean that we calculated. I was not saying that the phenomenon is not valuable. And the second thing that I --

MEMBER BLEY: I understand. That's what I thought you meant.

MR. HAMBURGER: Okay. The second thing that I wanted to mention was although this was not documented in the report we did have more than three scenarios made up at the time of the PIRT.

And after we got through the first scenario the group chose the remaining two scenarios based on how much time we had left and how much time we thought we would have to get through those scenarios.

So there was some group judgment in deciding which scenario we were going to use as part of the PIRT though it wasn't documented and your comments about the scope of the issue are certainly well taken. Thank you.

MEMBER REMPE: Thank you. Do we need to also open the line and we'll let the public, if there's anyone out there can someone, Theron, can we assume the lines are open for the public now?

CHAIRMAN CORRADINI: I hear noise.

MEMBER REMPE: Usually they'll come on and say line open.

CHAIRMAN CORRADINI: Can somebody acknowledge that they're out there on the public line please if anybody is out there?

MEMBER BLEY: This is Dennis. I'm on a separate line.

CHAIRMAN CORRADINI: Yes, we figured that. We've heard you enough.

MEMBER REMPE: Okay, well since we're not hearing anyone else I'm going to assume that there's no one out there that wants to speak. And we will plan that the draft will be provided some time in

December right now if that's okay with Margaret and Dennis.

MEMBER CHU: I think we can probably give it to you in November.

MEMBER REMPE: Okay, well the sooner the better and then we'll get a document together.

MEMBER CHU: We would also get it.

MEMBER REMPE: Yes, well before February and plan to try to have this on the agenda in February then. Great.

CHAIRMAN CORRADINI: I just would emphasize that it's important that you kind of get it in a sense that you're happy with the result in terms of the writing and then you go with Joy. But we're not in a, from a rush standpoint, we're not in a rush.

We'll fit it in where we can. If we can fit it in November because you're done so quickly, fine. If we have to fit it in, in March, fine. It's not as if we're on some sort of enormous schedule.

MEMBER MARCH-LEUBA: Do we need to do another full committee on it?

MEMBER REMPE: No. Typically what we do is we give it to the whole committee about a month before and if they have any burning comments they will send them to Jose and the two chairs and myself and we'll get them resolved.

And then there's just like a single one page letter. So --

CHAIRMAN CORRADINI: There's the transmittal letter and that's it.

MEMBER MARCH-LEUBA: It will probably have to be involved on P&P.

MEMBER REMPE: Yes. Well it will be, there will be time on the agenda and we'll go through the letter. And if someone didn't like the way their comment was reserved that's the time to bring it up.

But usually it's more of a review offline. Thank you. And thank you again, to the two chairs and all the Members of the panels. Good discussion today.

CHAIRMAN CORRADINI: Okay. Dennis, are you going to stay with us for the letter or are we going to say goodbye to you?

MEMBER BLEY: As I said earlier, to you privately, if you want me around for the first reading okay. But I don't intend to stay for the letter. You ought to run that because I'm here I can't really participate except being an annoyance.

CHAIRMAN CORRADINI: Okay, that's fine.

MEMBER BLEY: I'm happy to let you guys go ahead with it.

CHAIRMAN CORRADINI: That's fine. All right. So we're going to take a break, Dennis, and then if you want to come back and listen to the reading that's fine otherwise that's fine too. But we'll come back at quarter to three.

(Whereupon, the above-entitled matter went off the record at 2:30 p.m.)

ACRS
October 4, 2018

Emergency Preparedness for Small Modular Reactors and Other New Technologies Proposed Rulemaking

10 CFR Parts 50 and 52

NRC-2015-0225

RIN 3150-AJ68

- Project Manager: Andy Carrera (NMSS)
- Technical Leads: Kenneth Thomas (NSIR)
  Arlon Costa (NRO)

Emergency Preparedness for Small Modular Reactors and Other New Technologies Proposed Rulemaking

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- Purpose of Rulemaking
  - Amend regulations for new alternative, performance-based EP requirements for SMRs and ONTs.
  - Address one of the policy, licensing, and technical issues identified in SECY-10-0034
- Source term, security, and siting criteria are not affected by this rule.

Emergency Preparedness for Small Modular Reactors and Other New Technologies Proposed Rulemaking

- Major provisions of this proposed rule:
  - technology-inclusive for future SMRs and ONTs, including medical radioisotope facilities and non-light-water reactors
  - performance-based EP framework, including demonstration of effective response in drills and exercises
  - hazard analysis for contiguous facilities
  - scalable approach for plume exposure pathway EPZ
  - ingestion response planning for SMRs and ONTs

- Comments from ACRS Subcommittee Meeting August 22:
  - Source terms
    - Governed by separate rules and guidance
    - Those rules and guidance are not within the scope of this rulemaking
  - 1000 MWt
    - No technical analysis
    - Existing large light-water reactors
  - Hazard analysis
    - Updated by the provisions in § 50.54(q)(2)

Emergency Preparedness for Small Modular Reactors and Other New Technologies Proposed Rulemaking

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- Comments from ACRS Subcommittee Meeting August 22:
  - 96 hours
    - Used by the EPA in the PAG manual, section 2.2
    - Dose projections measure integrated 4-day dose
  - Multiple modular considerations
    - Details are in DG, Staff Regulatory Position 8
  - Documents are publicly available
    - Made public in September
  - Use of "Other New Technologies"
    - Used in FRN, SECY, and DG

Emergency Preparedness for Small Modular Reactors and Other New Technologies Proposed Rulemaking

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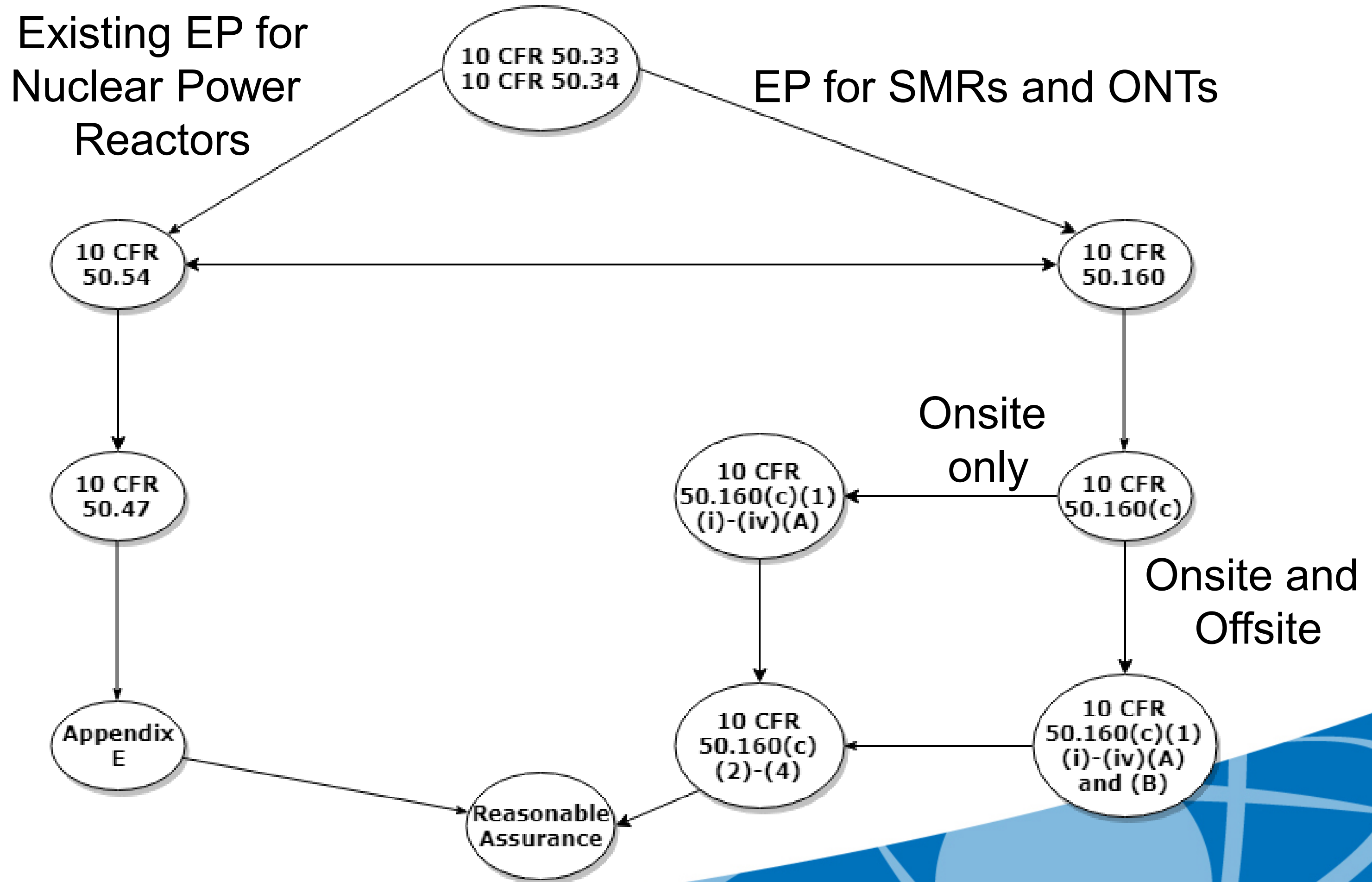
- EPZ size technical analysis
  - The plume exposure pathway EPZ should encompass an area where prompt protective measures, such as evacuation and sheltering, may be needed to minimize the exposure to individuals.
  - The analysis should consider radiological releases from credible accidents for the facility.
  - Scalable EPZ
    - If EPZ ≤ site boundary ➔No NRC requirement for offsite radiological emergency preparedness programs
    - If EPZ > site boundary ➔NRC requirements for offsite radiological emergency preparedness programs

Emergency Preparedness for Small Modular Reactors and Other New Technologies Proposed Rulemaking



Emergency Preparedness for Small Modular Reactors and Other New Technologies Proposed Rulemaking

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- Scalable approach for plume exposure pathway EPZ
  - Consistent with the analyses documented in NUREG-0396
  - Consistent with the existing graded-approach afforded to:
    - Research and test reactors
    - Fuel cycle facilities
    - Independent spent fuel storage installations
- Same level of protection afforded to public health and safety
- Development of guidance supported by Office of Nuclear Regulatory Research

Emergency Preparedness for Small Modular Reactors and Other New Technologies Proposed Rulemaking

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- Ingestion response planning
  - Early phase of the response
    - Precautionary protective actions
      - Washing garden products and food
      - Placing livestock on stored feeds
  - Longer term actions
    - Leading indicator drives response
  - Biological contamination similarities

Status and Path Forward

U.S.NRC
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- Draft proposed rule due to Commission on October 12, 2018.
  - Draft regulatory guidance is planned for issuance with proposed rule in early 2019 (pending Commission's approval).
  - Public meeting during public comment period of proposed rule.
- Draft final rule due to Commission in early 2020.

Abbreviations

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

ACRS – Advisory Committee on Reactor Safeguards

CFR – Code of Federal Regulations

OEDO – Office of the Executive Director of Operations

EP – emergency preparedness

EPZ – emergency planning zone

FEMA – Federal Emergency Management Agency

FRN – Federal Register Notice

MWt – Megawatts thermal (units for reactor power)

Accident Source Terms for EPZ Size Considerations

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- Evaluate a range of accidents credible for the facility
  - Use DBA and severe accident source terms developed to support other required safety and environmental assessments
  - Multi-module is considered
- Guidance exists for LWRs
  - DBA releases (new reactors)
    - SRP 15.0.3, RG 1.183 – AST (based on NUREG-1465)
    - SRP 11.1, 12.2 – coolant activity, radiation sources
    - SRP 3.11, RG 1.89 - EQ
  - Severe accident releases
    - SRP 19.0, 19.2
    - PRA standards

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ACRS 657th Full Committee Meeting

Summary of Operating Experience for CY2017 and MY2018

Gordon Skillman, ACRS

October 4, 2018

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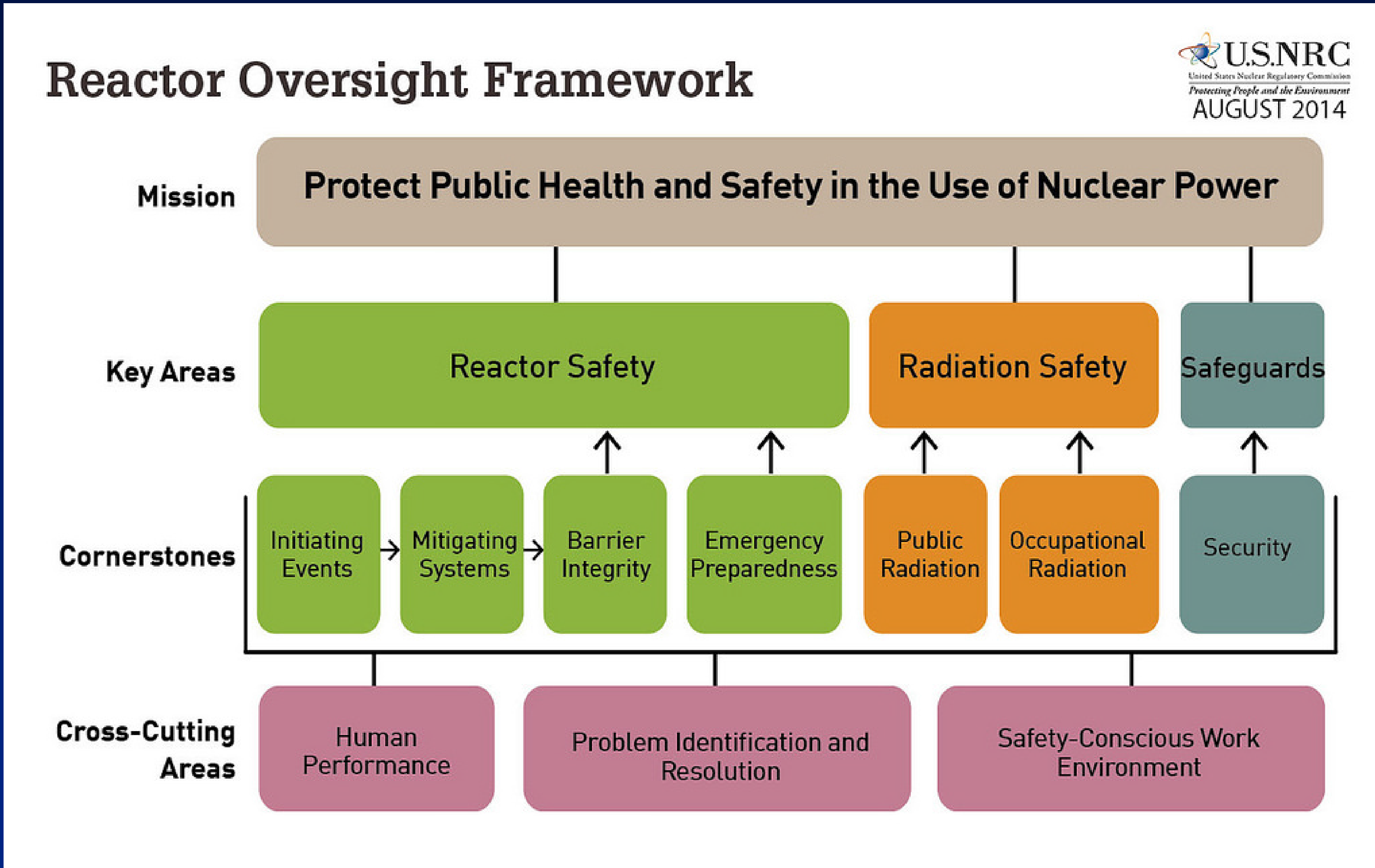
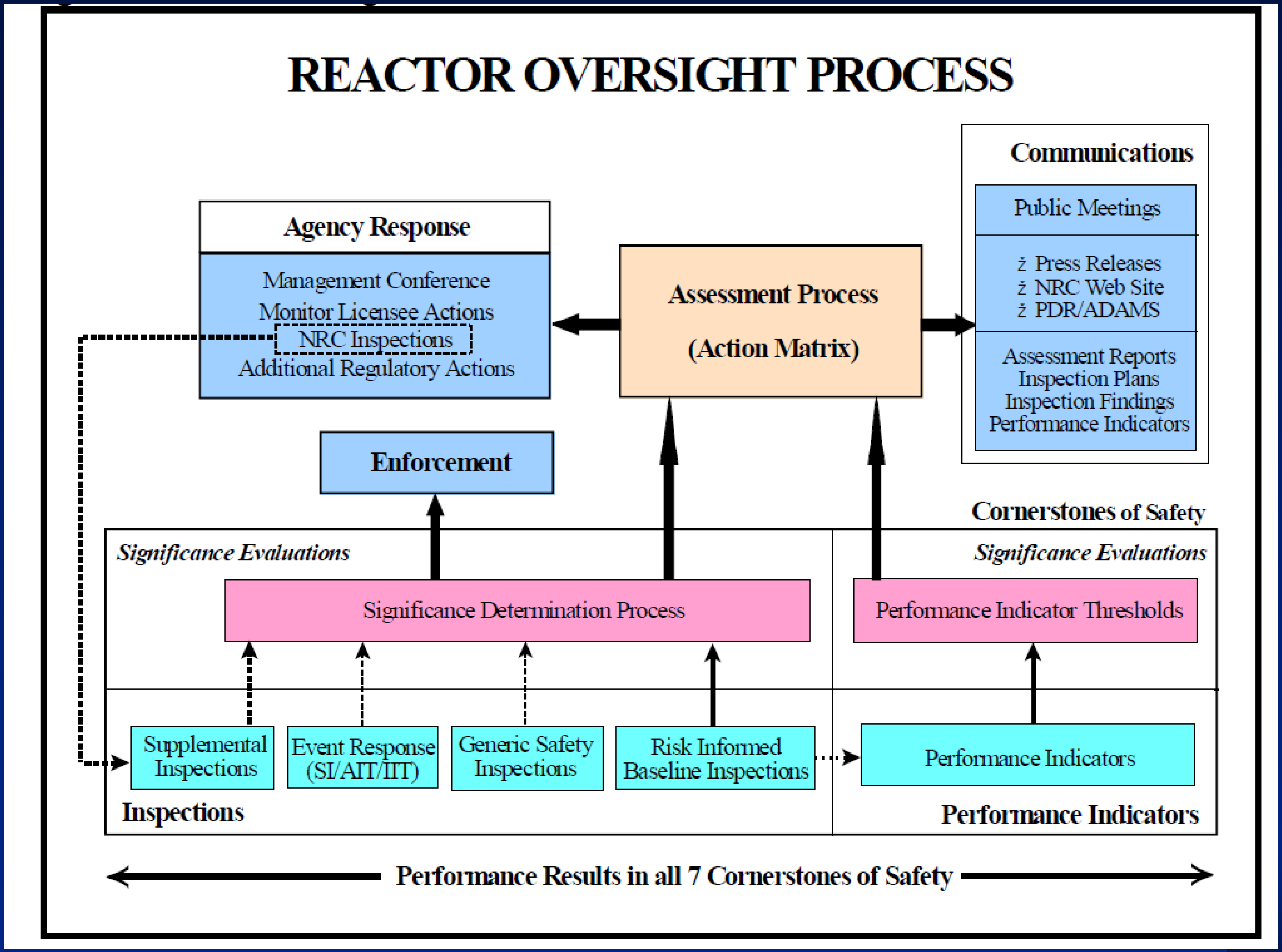
ROP Framework



ROP Process



REACTOR OVERSIGHT PROCESS
Communications
Public Meetings
Press Releases
NRC Web Site
PDR/ADAMS
Assessment Reports
Inspection Plans
Inspection Findings
Performance Indicators
Agency Response
Management Conference
Monitor Licensee Actions
NRC Inspections
Additional Regulatory Actions
Assessment Process
(Action Matrix)
Enforcement
Cornerstones of Safety
Significance Evaluations
Significance Evaluations
Significance Determination Process
Performance Indicator Thresholds
Supplemental Inspections
Event Response (SI/AIT/IIT)
Generic Safety Inspections
Risk Informed Baseline Inspections
Performance Indicators
Inspections
Performance Indicators
Performance Results in all 7 Cornerstones of Safety

CY2017 and MY18 ROP

Total Number of Plants in ROP Evaluation:

Region I = 25

Region II = 34

Region III = 23

Region IV = 19

TOTAL = 101

CY2017 and MY18 ROP

Inspection Findings – Quantitative Thresholds

Red	
CDF	greater than 10-4ΔCDF or
LERF	greater than 10-5 ΔLERF

Yellow	
CDF	greater than 10-5 and less than or equal to 10-4 ΔCDF or
LERF	greater than 10-6 and less than or equal to 10-5 ΔLERF

White	
CDF	greater than 10-6 and less than or equal to 10-5 ΔCDF or
LERF	greater than 10-7 and less than or equal to 10-6 ΔLERF

Green	
CDF	less than or equal to 10-6 ΔCDF or
LERF	less than or equal to 10-7 ΔLERF

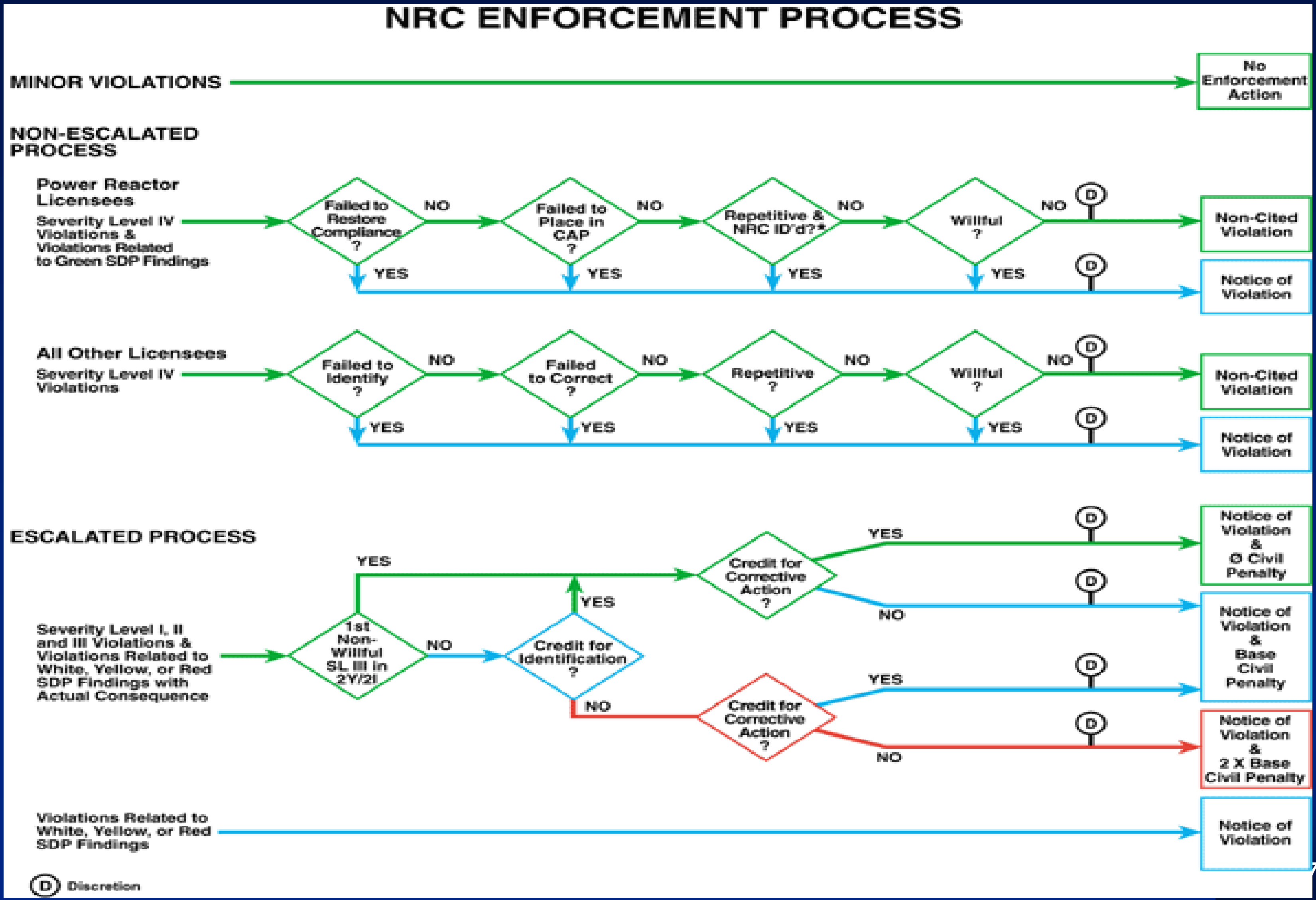
CY2017 and MY18 ROP

Inspection Findings

(Qualitative Definitions)

- **Green:** **a finding of very low safety or security significance**
- **Greater-Than-Green:** **a finding of more than very low significance – <u>security cornerstone only</u>**
- **White:** **a finding of low to moderate safety or security significance**
- **Yellow:** **a finding of substantial safety or security significance**
- **Red:** **a finding of high safety or security significance**

CY2017 and MY18 ROP



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CY 2017* Inspection Findings

	Number of Plants						
Insp. Find.	Safety Cornerstone						
	Initiating Events	Mitigating Systems	Barrier Integrity	Emerg. Prep.	Occ. Rad Safety	Pub. Rad. Safety	Security
Red	0	0	0	0	0	0	?
Yellow	2	2	0	0	0	0	?
White	2	5	0	1	0	0	?
GTG	-	-	-	-	-	-	6
Green	27	81	38	7	9	5	26

*** Snapshot at end of 4th QTR 17 that shows all findings from previous 4 QTRs**
? = Red, Yellow, or White designation is SUNSI, reported as GTG.

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MY2018 ROP

MY 2018* Inspection Findings

	Number of Plants						
Insp. Find.	Safety Cornerstone						
	Initiating Events	**Mitigating Systems**	**Barrier Integrity**	**Emerg. Prep.**	**Occ. Rad Safety**	**Pub. Rad. Safety**	**Security**
Red	0	0	0	0	0	0	?
Yellow	0	0	0	0	0	0	?
White	1	5	0	0	0	0	?
GTG	-	-	-	-	-	-	3
Green	43	86	43	9	20	10	42

*** Snapshot at end of 2nd QTR 18 that shows all findings from previous 4 QTRs**
Only new (1st or 2nd QTR 2018) presented in following slides

CY2017 ROP

Inspection Findings

Safety and Rad Protection Cornerstones

- **Four Yellows (2017)**

  - **Two Each at Arkansas 1 and 2 (Both CY2015 and 2016):**
    - **Initiating Events Cornerstone**
    - **Mitigating Systems Cornerstone**

  - **Resolved and No Longer show (see MY2018 ROP)**

CY2017 ROP

Inspection Findings (S&RP)

– **Four Yellows - Arkansas Nuclear 1 and 2 – Historic:**

- **Initiating Events Cornerstone:**
  - Failure to Follow the Materials Handling Program during the Unit 1 Generator Stator Drop – Initially in 1st QTR 2014
  - LOOP of 6 days Unit 1; Partial LOOP Unit 2
- **Mitigating Systems Cornerstone:**
  - Inadequate Flood Protection for Auxiliary and Emergency Diesel Fuel Storage Buildings Concurrent with Stator Drop Event
  - Over 100 Flood Barriers Inadequate
- **Placed in Col 4 of Matrix Assessment**
- **Supplemental Inspection Procedure (IP) 95003 planned**

Inspection Findings (S&RP)

- **Four Yellows - ANO 1 and 2 – Historic (continued):**
  - **2nd & 3rd QTRs 2014 – Unplanned Scrams/7000 Hrs White PI**
  - **Subsequent decision to also conduct Supplemental Inspections 95001 and 95002**
  - **3 Supplemental Inspections Conducted Jan & Feb 2016**
  - **Entergy submitted "ANO Comprehensive Recovery Plan Area Action Plans," May 2016 to respond to recover from Col 4**
  - **NRC Issued Confirmatory Action Letter (CAL) June 2016**
- **Finally -**
  - **Inspection May 2018 – All actions completed, CAL closed, and assessment of performance of ANO 1 & 2 updated (reflected in 2018)**

Inspection Findings (S&RP)

– **Whites – 8 Plants**

- **2 Plants in Initiating Events Cornerstone:**
  - Grand Gulf 1 – Parallel Performance Indicator White Finding
  - St. Lucie 1 – Loss of Configuration Control
- **5 Plants in Mitigating Systems Cornerstone:**
  - Catawba; Clinton; Oyster Creek; Perry 1; Pilgrim
  - Various Systems / Causes
- **1 Plant in Emergency Preparedness Cornerstone:**
  - Fermi - Failure to Maintain Effectiveness of Site EP

Inspection Findings (S&RP)

- **White at Grand Gulf 1 (IE)**
  - Parallel Performance Indicator White Inspection Finding.
  - PI = Unplanned scrams per 7000 hours
  - Inadequate and Weaknesses in response to White Performance Indicator reported by licensee in 3rd QTR 16.
  - **Poor Root Cause Analysis**
- **White at Saint Lucie 1 (IE)**
  - Failure to maintain configuration control of the Unit 1 main generator inadvertent energization lockout relay circuitry.
  - Resulted in reactor trip and loss of offsite power (LOOP) on August 21, 2016.
  - 2E-6 change in core damage frequency (ΔCDF).

Inspection Findings (S&RP)

- **White at Catawba (MS)**
  - Failure to adequately develop and adjust preventive maintenance activities in accordance with procedure.
  - Failed to develop preventive maintenance strategies which considered operating experience for the emergency diesel generator (EDG) excitation system.
- **White at Clinton (MS)**
  - Failure to evaluate the change in the dropout voltages for replacement relays associated with the Div. 1 EDG Room Vent Fan.
  - Change in dropout voltages prevented the fan from operating during an under voltage condition,
  - Division 1 EDG became inoperable.

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CY2017 ROP Inspection Findings (S&RP)

- **<u>White at Oyster Creek (MS)</u>**
  - Tech Spec violation - failure to follow the electromatic relief valve (EMRV) reassembly instructions, which caused the 'E' EMRV to be incorrectly reassembled.
  - 'E' EMRV was determined to be inoperable for greater than the technical specification allowed outage time.
  - Supplemental 95001 Inspection completed Sept 17
- **<u>White at Perry 1 (MS)</u>**
  - Failure to evaluate the effects of voltage suppression diode failure on the Standby Diesel Generator (SDG) control circuit.
  - Introduction of new components (diodes) into the control circuitry resulted in the eventual failure of the SDG control circuit.
  - SDG inoperable and unable to start.

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CY2017 ROP

Inspection Findings (S&RP)

- **White at Pilgrim (MS)**
  - Failure to identify, evaluate, and correct a significant condition adverse to quality associated with the ‘A’ safety/relief valve (SRV).
  - Failed to correct the ‘A’ SRV’s failure to open upon manual actuation during a plant cool-down on 2/9/13, following a LOOP event.
  - Subsequent 1/27/15 failure of ‘C’ SRV could have been avoided.
  - Supplemental 95001 - collective issues associated with the root cause evaluation represented a significant weakness.
  - Supplemental 95003 (May 17) for different purpose extended to cover this finding.

Inspection Findings (S&RP)

- **White at Fermi (EP)**
  - Failure to maintain the effectiveness of the EP and use adequate methods, systems, and equipment for assessing and monitoring actual or potential offsite consequences of a radiological emergency.
  - Failure to accurately analyze the effect of increasing background radiation on the site's Standby Gas Treatment System (SGTS) accident range radiation monitor (AXM)
  - As configured, the AXM would provide inaccurate indications of radioactive releases that are used as the licensee's basis for determining EAL classification and development of PARs.

Inspection Findings(S&RP)

- **No More Yellow Findings**

- **Whites - Reduced to 4 Plants**
  - **Only 1 New Finding since 4th QTR 2017**
  - **Mitigating Systems Cornerstone:**
    - **Davis-Besse**

MY2018 ROP

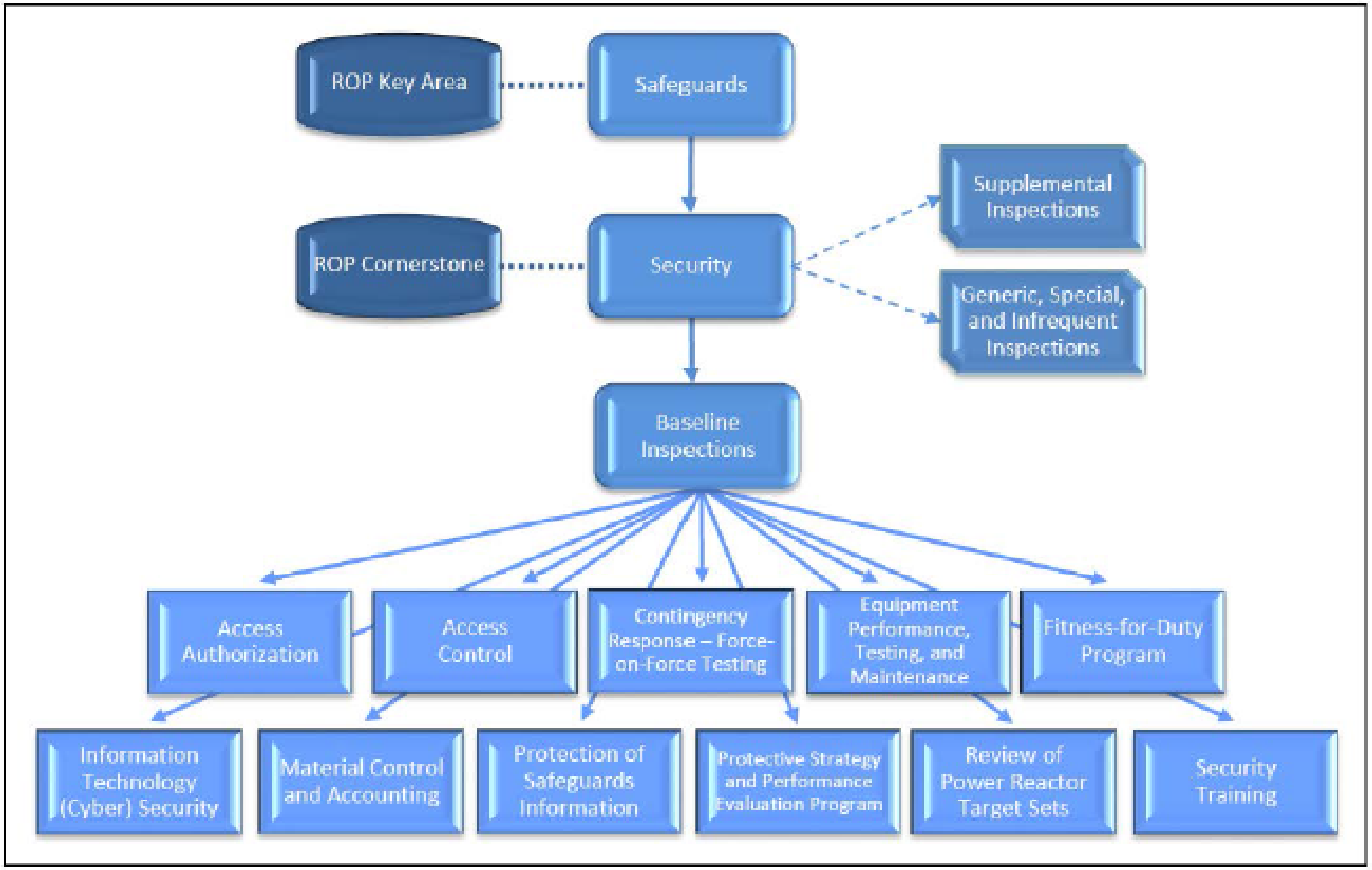
Inspection Findings (S&RP)

- **White at Davis-Besse (MS)**
  - Failure to provide appropriate instructions to maintain adequate oil in auxiliary feedwater turbine bearing oil sumps.
  - Led to failure of auxiliary feedwater pump.
  - Pump found to be inoperable for > tech spec limit.

CY2017 and MY18 ROP

Security Cornerstone

Figure 2 Inspectable Areas of the Security Cornerstone



CY2017 and MY18 ROP

Inspection Findings – Security Cornerstone

– Plants Greater-Than-Green; 4 in CY16; 6 in CY17; 3 in MY18 (not including Force-on-Force)

– GTG is not a "new" category, it means the finding was either white, yellow, or red

– Details are SUNSI and not publically available

– But NUREG-1885 - Annual non-SUNSI report provided to Congress

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CY2017 ROP

Security Cornerstone

Baseline Inspection Findings

Table 2: Calendar Year 2017 Security Inspection Summary for Commercial Nuclear Power Reactors (without Force-on-Force)

215	Total number of security inspections conducted
106	Total number of inspection findings

98	Total number of Green findings
3	Total number of greater-than-Green findings
5	Total number of SL IV violations
0	Total number of greater-than-SL IV violations

Table 3: Calendar Year 2017 Security Inspection Summary for Category I Fuel Cycle Facilities (without Force on Force)

15	Total number of security inspections conducted
4	Total number of inspection findings

4	Total number of SL IV violations
0	Total number of greater-than-SL IV violations

CY2017 ROP

Security Cornerstone - Inspection Findings

Force – on – Force Exercises

Table 1: Calendar Year 2017 Force-on-Force Inspection Program Summary

19	Total number of inspections conducted (two exercises per inspection)
34	Total number of effective exercises
0	Total number of indeterminate exercises
3	Total number of marginal exercises
1	Total number of ineffective exercises
0	Total number of canceled exercises
9	Total number of inspection findings
9	Total number of Green findings
0	Total number of greater-than-Green findings
0	Total number of SL IV violations
0	Total number of greater-than-SL IV violations

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CY2017 ROP

Force-On-Force Exercises

- **No Greater-than-Green Findings**
- **1 Ineffective Exercise:**
  - **Licensees' inability to demonstrate an effective implementation of its protective strategy to defend designated target set components**
- **3 Marginal Exercises:**
  - **In all three cases, licensees neutralized the adversary at a location, or in preparation to enter a location, that contained a single element target set.**
- **Licensees all took appropriate corrective actions.**
  - **Policy and procedure changes**
  - **Physical security upgrades and technology improvements**
  - **Personnel or security force enhancements**

Cross-Cutting Issues

- **NRC evaluates whether cross-cutting issues exist at NPPs 2x/year: at mid-cycle and end-of-cycle assessments:**
  - **No New Open Issues in 2017**
  - **No Data reported yet for mid-cycle 2018 assessments**

CY2017 and MY18 ROP

Safety Cornerstone	Performance Indicators
#1 Initiating Events	• Unplanned reactor shutdowns, or "scrams" (automatic and manual) • Complicated unplanned shutdown • Unplanned events that result in significant changes in reactor power
#2 Mitigating Systems	• Safety system availability and reliability • Safety system failures
#3 Barrier Integrity	• Fuel cladding (measured by radioactivity in reactor cooling system) • Reactor cooling system leak rate
#4 Emergency Preparedness	• Emergency response organization drill performance • Readiness of emergency response organization • Availability of notification system for area residents
#5 Occupational Radiation Safety	• Unplanned radiation exposures to workers
#6 Public Radiation Safety	• Effluent releases requiring reporting under NRC regulations and license conditions
#7 Security	• Security system equipment availability

Performance Indicators

- **Green: performance within an expected level where all cornerstone objectives are met**
- **White: performance outside an expected range of nominal utility performance but related cornerstone objectives are met**
- **Yellow: related cornerstone objectives are met, but with a minimal reduction in safety margin**
- **Red: significant reduction in safety margin in area measured by the PI**

CY2017 ROP Performance Indicators

- NO Plants with Red or Yellow
- Two Plants with White

CY2017 ROP

Performance Indicators

IE04 - Unplanned Scrams with Complications

- Columbia Generating Station

White Threshold > 1.0			
1Q	2Q	3Q	4Q
1.0	1.0	2.0	1.0

- Unplanned scrams with complications occurred in 4th QTR 16 and 3rd QTR 17

CY2017 ROP

Performance Indicators

IE01 - Unplanned Scrams per 7000 Critical Hours

- **Watts Bar 2**

White Threshold > 3.0			
1Q	**2Q**	**3Q**	**4Q**
NR	NR	1.4	**3.1**

NR = Watts Bar 2 went online October 2016. Significant critical hours to require reporting not reached until 3Q17.

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MY2018 ROP

Performance Indicators

No Red, Yellow or White

Thru first two quarters

Of 2018

ROP Action Matrix

Inspection Findings

+

Performance Indicators

=

Plant Assessment

ROP Action Matrix Assessment

- **Column 5: Unacceptable Performance**
- **Column 4: Multiple/Repetitive Degraded Cornerstone**
- **Column 3 Degraded Cornerstone**
- **Column 2: Regulatory Response**
- **Column 1: Licensee Response**

CY2017 and MY18 ROP

Increasing Safety Significance

ROP Action Matrix Asessment of Plant Performance	NRC Response
Column 5. Unacceptable Performance	**Response at Agency Level** • Meeting with NRC Executive Director for Operations and senior plant management • Order to modify, suspend, or revoke license
Column 4. Multiple/Repetitive Degraded Cornerstone Repetitive degraded cornerstone, multiple degraded cornerstones, or multiple **YELLOW** inputs, or one **RED** input	**Response at Agency Level** • Meeting with NRC Executive Director for Operations and senior plant management • Plant operator improvement plan with NRC oversight • NRC team inspection focused on performance issues at the site • Demand for Information, Confirmatory Action Letter, or Order
Column 3. Degraded Performance One degraded cornerstone (three **WHITE** inputs or one **YELLOW** input in a cornerstone) or three **WHITE** inputs in any strategic area	**Response at Regional Level** • Meeting with NRC regional management and senior plant management • Plant operator self-assessment with NRC oversight • Additional NRC inspections focused on cause of degraded performance
Column 2. Regulatory Response No more than two **WHITE** inputs in a strategic area	**Response at Regional Level** • Meeting with NRC and plant management • Plant operator corrective actions to address **WHITE** inputs • NRC inspection to follow up on **WHITE** inputs and corrective actions
Column 1. Licensee Response All performance indicators and cornerstone inspection findings **GREEN**	**Normal Regional Oversight** • Routine inspector and staff interaction • Baseline inspection program • Annual assessment public meeting

Increasing Regulatory Oversight

CY2017 ROP

ROP Action Matrix Assessment

	Number of Plants in Each Column (per QTR)				
2017	Col 1	Col 2	Col 3	Col 4	Col 5
QTR	Licensee Response	Regulatory Response	Degraded Cornerstone	Multiple/Repetitive Degraded Cornerstone	Unacceptable
1	82	16	0	3*	0
2	84	14	0	3*	0
3	86	12	0	3*	0
4	89	9	0	3*	0

* Arkansas 1 & 2, and Pilgrim

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MY2018 ROP

ROP Action Matrix Assessment

	Number of Plants in Each Column (per QTR)				
2018	Col 1	Col 2	Col 3	Col 4	Col 5
QTR	Licensee Response	Regulatory Response	Degraded Cornerstone	Multiple/Repetitive Degraded Cornerstone	Unacceptable
1	95	5	0	1*	0
2**	x	x	x	x	x
3	x	x	x	x	x
4	x	x	x	x	x

* Pilgrim

** 2nd QTR 2018 Action Matrix Summary data not posted on website yet, most Mid-Year Assessment letters are available.

Action Matrix Summary Highlights

- **Arkansas Nuclear 1 & 2 – Back in Column 1 in 2018 after being in Column 4 since 1st QTR 2015**

Action Matrix Summary Lowlights

- **Pilgrim** 1 – **6** consecutive QTRs in Col. 3 (starting 4th QTR 2013) followed by **13** consecutive QTRs in Col. 4 since then.
  - NRC "muted" response considers Pilgrim plans to shutdown.

- Grand Gulf 1 – 8 consecutive QTRs in Col. 2 (started 3rd QTR16 – back in Col 1)
- Clinton – 4 consecutive QTRs in Col. 2 (starting 3rd QTR17 – remains in Col. 2) *
- Columbia – 4 consecutive QTRs in Col. 2 (all 4 QTRs of 2017 – back in Col 1)

* Supplemental Inspection conducted September 18, 2018.

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CY2016 & 17 FFD

Fitness for Duty

- **Electronic Reporting since 2009**
- **Summary Reports available from some licensees**
- **No Industry-Wide Summaries being prepared as in the past**
- **NRC staff provides annual briefing to Drug Testing Advisory Panel**

- **Tests conducted on licensee and C/V employees**

CY2016 & 17 FFD

Fitness for Duty

- **5 Types of Tests Conducted:**
  - **Pre-Access** (applicants for employment)
  - **Random** (unscheduled/unannounced for employees)
  - **For Cause** (behavior of, or information received about employee)
  - **Post-Event** (after an event involving human error)
  - **Follow-up** (after a positive test)

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CY2016 & 17 FFD

Fitness for Duty Data (2008-2014)

- **Three Multi-year Trends were being tracked:**
  - **Subversion attempts prevalent since CY2011 (18 to 21% of violations: 143 to 187 events per year) with 54 to 66% of sites reporting at least one.**
  - **Amphetamine positive results increasing since CY2008 (from 3.8% (in 2008) to 10.6% (in 2014) of drug & alcohol positives.**
  - **Reactor construction sites have higher positive rates, primarily in pre-access and random tests, and have higher incidence of subversion attempts than operating reactor sites.**

CY2016 & 17 FFD

Fitness for Duty Data (2008-2014) (cont)

- In February 2017, the NRC staff submitted a proposed rule to the Commission (SECY-17-0027) for consideration.
- The proposed rule, in part, would address those three multi-year trends by lowering the testing cutoff levels for amphetamine and methamphetamine, and expanding testing measures related to subversion attempt detection.
- No Commission Response yet.

CY2016 & 17 FFD

- MEANWHILE - **Subversion attempts prevalent since CY2011 continue to rise**

- <u>Subversion Attempt Trends:</u>
  - 2012 – 177 of 1,114 violations (15.8% subversions)
  - 2013 – 148 of 1,007 violations (14.7% subversions)
  - 2014 – 187 of 1,133 violations (16.5% subversions)
  - 2015 – 232 of 1,200 violations (19.3% subversions)
  - 2016 – 304 of 1,164 violations (26.1% subversions)
  - 2017 – 298 of 1,143 violations (26.1% subversions)

- <u>Subversion Attempts in 2017</u>:
  - 45 facilities with at least 1 subversion attempt
  - 67% identified at Pre-Access testing (200 of 298)
  - 98% by contractor/vendors

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CY2016 & 17 FFD

Fitness for Duty Data (cont.)

- **Overall industry positive rate CY17 = 0.77% (0.76% in CY16)**
  - **Low, but continues upward trend since CY12 and 13 (both were 0.62%)**
- **Total tests in CY2017 decreased by 3.6%**
  - **Tests in CY2016 decreased by 5.9% from CY2015**
  - **Continuing downward trend**
- **Approx 64% of CY17 positives and refusals occur at pre-access**
  - **Prevents access, directly protecting public health and safety**
  - **Almost constant percentage (65%) for several years**
- **Random testing CY17 identified 22.7% of substance users**
  - **Identifies more employees using substances than pre-access**
  - **22.3% in CY2016; Continues upward trend since 2014**

CY2016 & 17 FFD

Fitness for Duty Data (cont.)

- **For cause testing continues to have highest positive rate (9.9%)**
  - **(But is trending down 13.40% in CY13, 12%in CY14; 6% in CY16)**

- **Three substances continue to account for ≈85% of positives**
  - **Marijuana (≈ 50%), Alcohol (≈ 23%), Cocaine (≈ 12%)**
  - **Amphetamine positives continuing upward trend, now nearly same percentage as cocaine.**
  - **Cocaine positives way down from high in 2006, but trending up again.**
  - **Opiate positives way down (only 1% in CY 2017))**

Fitness for Duty Data (cont.)

- **Events concerning individual employee violations must be reported to NRC within 24 hours**
- **33 <u>24-hour</u> reportable events in 2017**
  - **15 involved Supervisors/Managers**

2017 Abnormal Occurrence Report

Annual Abnormal Occurrence Report to Congress

- **No AOs at NPPs**
- **11 AOs at Medical Facilities**
- **1 Significant Event that does not meet definition of AO:**
  - **Exposure at National Institute of Standards and Technology (NIST), Gaithersburg MD**

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Questions ?

Reactor Oversight Process Updates

Anticipating Degrading Licensee Performance
Reactor Oversight Process Enhancement Proposals

ACRS Full Committee

Greg Bowman and Tom Hipschman, NRR/DIRS
October 4, 2018

Background

- The Reactor Oversight Process (ROP) is designed to identify declining licensee performance prior to loss of reasonable assurance of adequate protection
  - Columns 2-4 of the Action Matrix provide this “buffer”
  - 9500x procedures guide the associated agency response
- That notwithstanding:
  - ACRS and others have wondered about “leading indicators”
  - The Commission has, in various forums, encouraged the staff to continue thinking about this topic
  - We routinely evaluate the effectiveness of the ROP (e.g., the annual self assessment) and seek to continually improve

Previous Discussions

- Various discussions have highlighted ideas such as:
  - Trend in the # of findings
    - Green findings
    - Quality assurance / Appendix B-related findings
    - Maintenance Rule-related enforcement actions
  - Plant operations:
    - Work management
    - Material condition of the plant
    - Trend in unplanned outage rate relative to industry average
    - # of off-normal procedure entries
    - # of unplanned Limiting Condition for Operation (LCO) entries
    - Staffing resources
  - Trend in # of conditions requiring NRC notification (50.72/50.73)
    - Nature of these conditions (i.e., atypical?)
  - Industry (e.g., INPO) evaluations
  - Leadership performance

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Examples of Tailoring the Existing ROP

- A related point is how NRC adjusts the inspection program for plants that are:
  - Experiencing financial issues
  - Nearing cessation of permanent operation
- Inspection Manual Chapter (IMC) 2515, Appendix G
  - Provides inspection guidance for inspecting plants that are approaching shutdown and decommissioning
- Staff also utilizes a handful of means for addressing these situations:
  - Safety culture initiatives
  - Supplemental guidance memos to address specific cases
  - IMC governing resident activities calls out material condition and long-standing issues
  - Sample selection for inspection procedures that cover areas where financial difficulties could translate to degradation of performance (e.g., P&IR, Maintenance Effectiveness, Equipment Alignment)
  - Increased NRC management presence

Enhancing the Reactor Oversight Process

- NRC has a number of initiatives ongoing to make the ROP more effective and efficient. Examples include:
  - Improvements to the inspection report development process
  - Initiative to improve the minor/more-than-minor component of the issue screening process
  - Work to improve the NRC's engineering inspection program
- DIRS received input from stakeholders as part of the ongoing agency initiative associated with transformation:
  - ~70 recommendations from the internal stakeholders related to potential enhancements to the ROP
  - NEI publication and NRUG letter with initial industry proposals to improve the ROP
  - Follow-up letter from NEI with consolidated industry proposals

Internal Stakeholder Feedback

- The Transformation Team provided DIRS with consolidated stakeholder feedback related to ROP transformation.
- The feedback generally fit into several categories:
  - Changes to organization and staffing supporting oversight, primarily regional changes
  - Changes to frequency of inspections and focus of inspection procedures
  - Changes to make performance indicators more effective
  - Changes to the various components of the assessment process
  - Changes to make the enforcement program more risk-informed
  - Changes to streamline or eliminate inspection reports
- No assessment was done of the proposals; the input to consisted of direct feedback provide by NRC staff.

Recent Industry Feedback

- NEI letter submitted on September 19 (ML18262A322) and discussed at September 20 ROP public meeting
- Acknowledgment that the ROP remains a sound and effective oversight program.
- Provided some recommendations on how the ROP could be enhanced:
  - Impact of White findings (e.g., press releases, labeling and communication, type of inspection follow-up)
  - Reassess baseline inspection program (e.g., focused evaluation of inspection areas, reduce burden of MSPI)
  - Improvements to the SDP (e.g., improve specific SDPs, address differences in NRC and licensee models)
  - Resolution of inspection issues (e.g., communication of potential issues, resolution of low risk compliance issues)

Next Steps

- Establish working group(s) to obtain stakeholder input, evaluate proposals, develop recommendations.
  - Initial kick-off meeting took place on October 3
- Establish recurring discussion at monthly ROP public meetings, with separate focused public meetings on specific ROP enhancements.
  - Planning public meetings on October 18 and November 15 (tentative)
- Commission approval will be needed for any significant changes to the ROP, per Management Directive 8.13.

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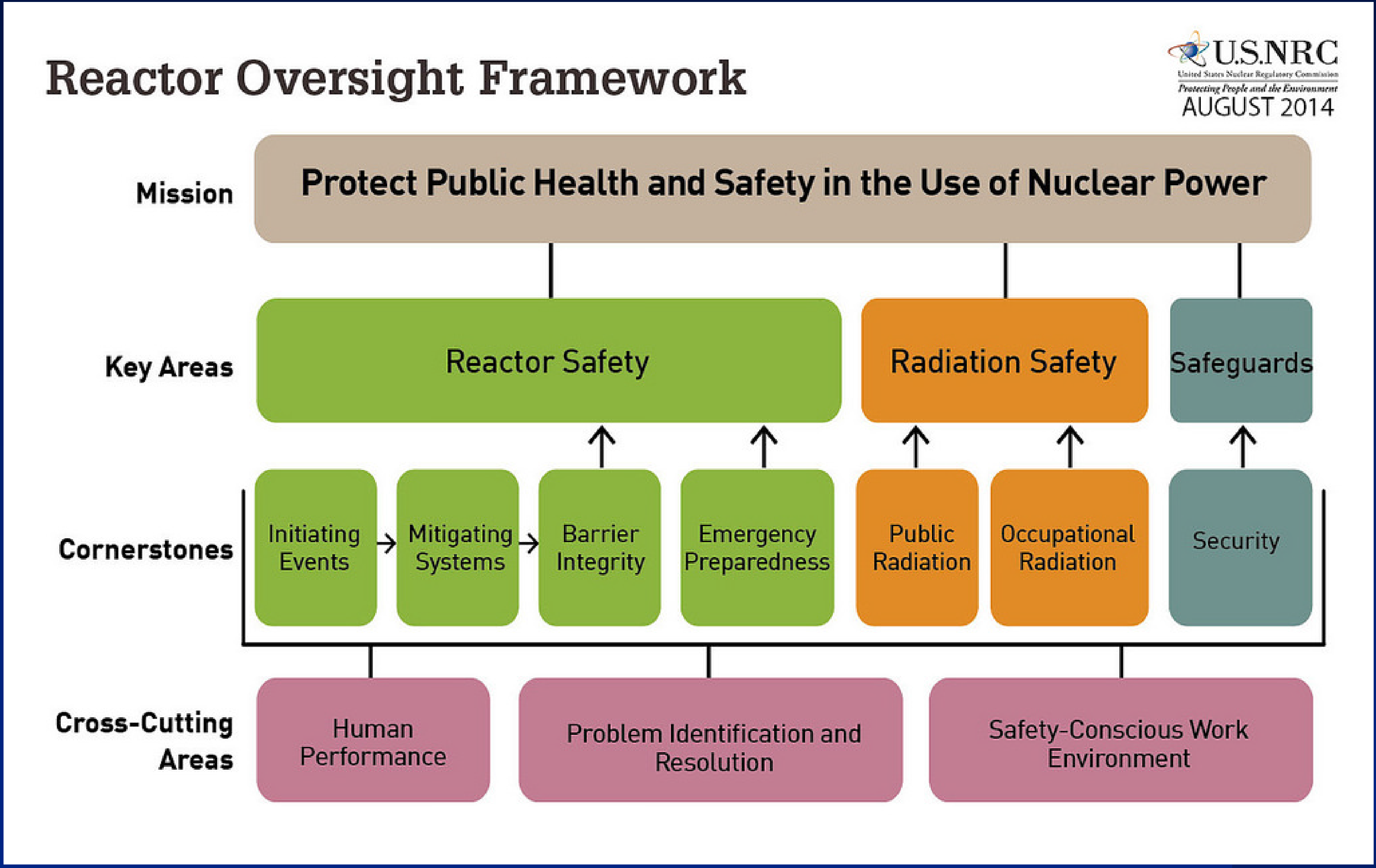
ACRS 657th Full Committee Meeting

Summary of Operating Experience for CY2017 and MY2018

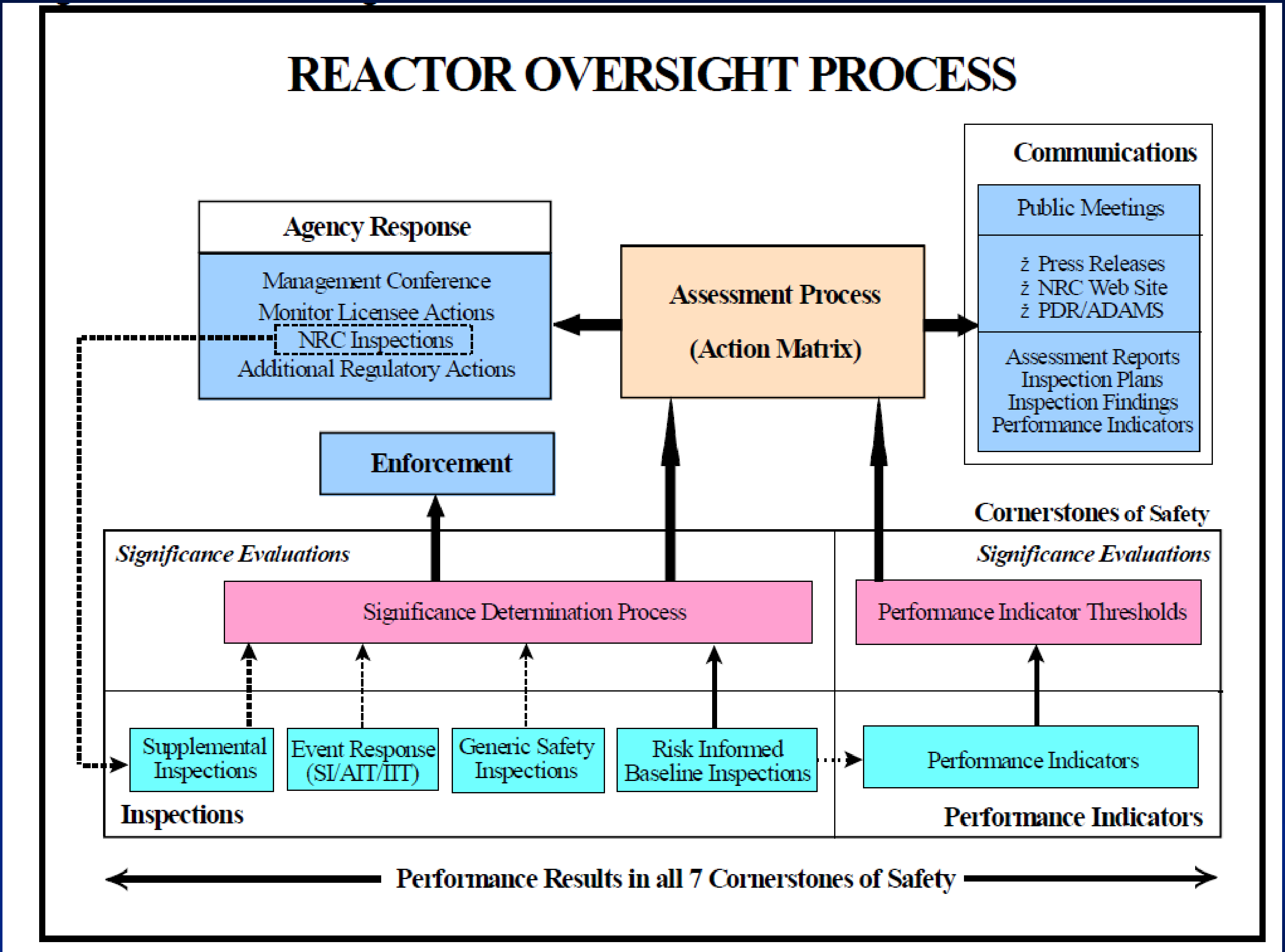
Gordon Skillman, ACRS

October 4, 2018

ROP Framework



ROP Process


REACTOR OVERSIGHT PROCESS
Communications
Public Meetings
ż Press Releases
ż NRC Web Site
ż PDR/ADAMS
Assessment Reports
Inspection Plans
Inspection Findings
Performance Indicators
Agency Response
Management Conference
Monitor Licensee Actions
NRC Inspections
Additional Regulatory Actions
Assessment Process
(Action Matrix)
Enforcement
Cornerstones of Safety
Significance Evaluations
Significance Evaluations
Significance Determination Process
Performance Indicator Thresholds
Supplemental Inspections
Event Response (SI/AIT/IIT)
Generic Safety Inspections
Risk Informed Baseline Inspections
Performance Indicators
Inspections
Performance Indicators
Performance Results in all 7 Cornerstones of Safety

CY2017 and MY18 ROP

Total Number of Plants in ROP Evaluation:

Region I = 25

Region II = 34

Region III = 23

Region IV = 19

TOTAL = 101

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CY2017 and MY18 ROP

Inspection Findings – Quantitative Thresholds

Red	
CDF	greater than 10-4ΔCDF or
LERF	greater than 10-5 ΔLERF

Yellow	
CDF	greater than 10-5 and less than or equal to 10-4 ΔCDF or
LERF	greater than 10-6 and less than or equal to 10-5 ΔLERF

White	
CDF	greater than 10-6 and less than or equal to 10-5 ΔCDF or
LERF	greater than 10-7 and less than or equal to 10-6 ΔLERF

Green	
CDF	less than or equal to 10-6 ΔCDF or
LERF	less than or equal to 10-7 ΔLERF

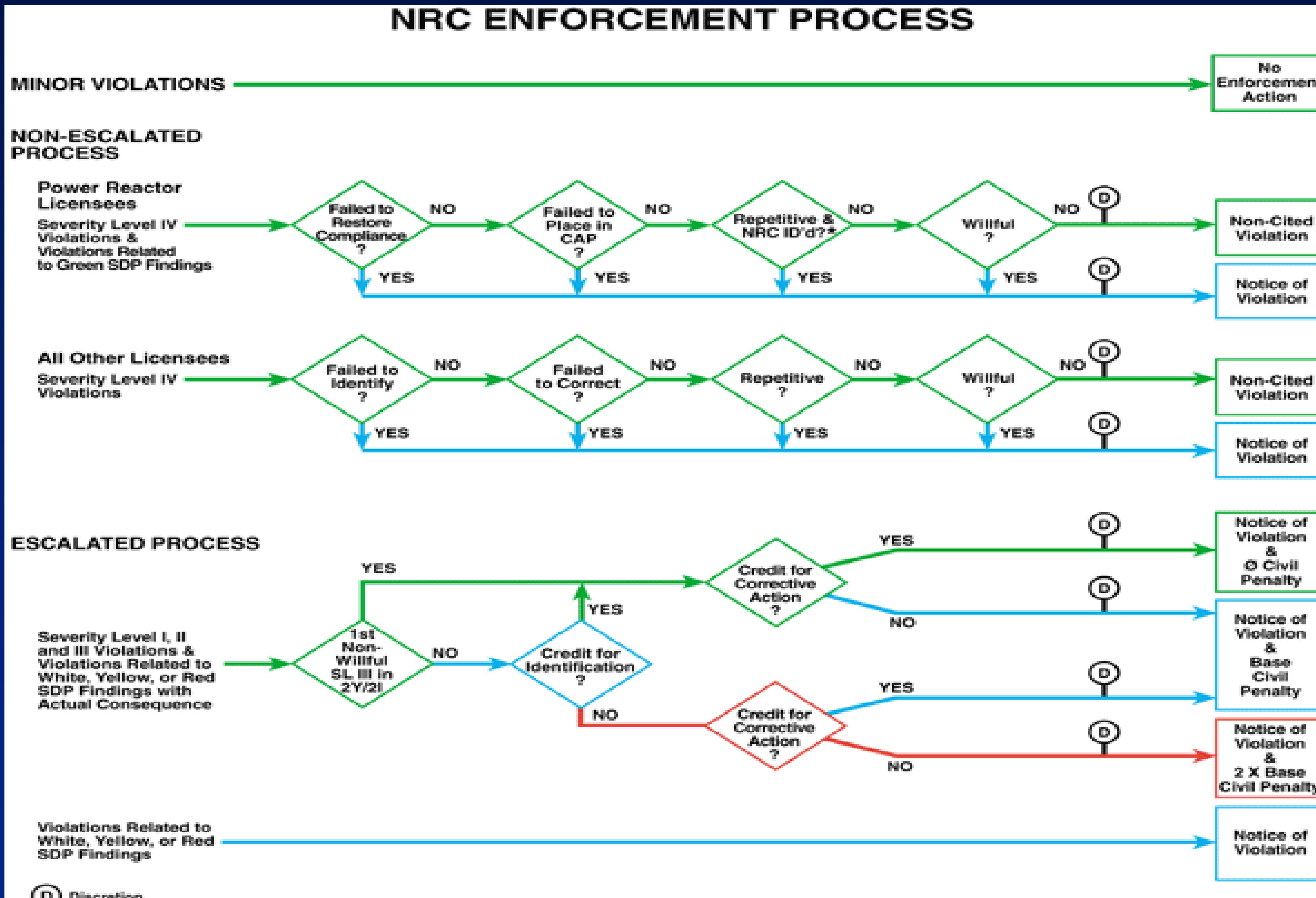
CY2017 and MY18 ROP

Inspection Findings

(Qualitative Definitions)

- **Green: a finding of very low safety or security significance**
- **Greater-Than-Green: a finding of more than very low significance – security cornerstone only**
- **White: a finding of low to moderate safety or security significance**
- **Yellow: a finding of substantial safety or security significance**
- **Red: a finding of high safety or security significance**

CY2017 and MY18 ROP



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CY2017 ROP

CY 2017* Inspection Findings

	Number of Plants						
Insp. Find.	Safety Cornerstone						
	Initiating Events	**Mitigating Systems**	**Barrier Integrity**	**Emerg. Prep.**	**Occ. Rad Safety**	**Pub. Rad. Safety**	**Security**
Red	0	0	0	0	0	0	?
Yellow	2	2	0	0	0	0	?
White	2	5	0	1	0	0	?
GTG	-	-	-	-	-	-	6
Green	27	81	38	7	9	5	26

*** Snapshot at end of 4th QTR 17 that shows all findings from previous 4 QTRs**
? = Red, Yellow, or White designation is SUNSI, reported as GTG.

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MY2018 ROP

MY 2018* Inspection Findings

	Number of Plants						
Insp. Find.	Safety Cornerstone						
	Initiating Events	**Mitigating Systems**	**Barrier Integrity**	**Emerg. Prep.**	**Occ. Rad Safety**	**Pub. Rad. Safety**	**Security**
Red	0	0	0	0	0	0	?
Yellow	0	0	0	0	0	0	?
White	1	5	0	0	0	0	?
GTG	-	-	-	-	-	-	3
Green	43	86	43	9	20	10	42

*** Snapshot at end of 2nd QTR 18 that shows all findings from previous 4 QTRs**
Only new (1st or 2nd QTR 2018) presented in following slides

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CY2017 ROP

Inspection Findings

Safety and Rad Protection Cornerstones

- **Four Yellows (2017)**

  - **Two Each at Arkansas 1 and 2 (Both CY2015 and 2016):**
    - **Initiating Events Cornerstone**
    - **Mitigating Systems Cornerstone**

  - **Resolved and No Longer show (see MY2018 ROP)**

Inspection Findings (S&RP)

– **Four Yellows - Arkansas Nuclear 1 and 2 – Historic:**

- **Initiating Events Cornerstone:**
  - Failure to Follow the Materials Handling Program during the Unit 1 Generator Stator Drop – Initially in 1st QTR 2014
  - LOOP of 6 days Unit 1; Partial LOOP Unit 2
- **Mitigating Systems Cornerstone:**
  - Inadequate Flood Protection for Auxiliary and Emergency Diesel Fuel Storage Buildings Concurrent with Stator Drop Event
  - Over 100 Flood Barriers Inadequate
- **Placed in Col 4 of Matrix Assessment**
- **Supplemental Inspection Procedure (IP) 95003 planned**

CY2017 ROP

Inspection Findings (S&RP)

- **Four Yellows - ANO 1 and 2 – Historic (continued):**
  - **2nd & 3rd QTRs 2014 – Unplanned Scrams/7000 Hrs White PI**
  - **Subsequent decision to also conduct Supplemental Inspections 95001 and 95002**
  - **3 Supplemental Inspections Conducted Jan & Feb 2016**
  - **Entergy submitted "ANO Comprehensive Recovery Plan Area Action Plans," May 2016 to respond to recover from Col 4**
  - **NRC Issued Confirmatory Action Letter (CAL) June 2016**
- **Finally -**
  - **Inspection May 2018 – All actions completed, CAL closed, and assessment of performance of ANO 1 & 2 updated (reflected in 2018)**

Inspection Findings (S&RP)

– **Whites – 8 Plants**

- **2 Plants in Initiating Events Cornerstone:**
  - **Grand Gulf 1 – Parallel Performance Indicator White Finding**
  - **St. Lucie 1 – Loss of Configuration Control**
- **5 Plants in Mitigating Systems Cornerstone:**
  - **Catawba; Clinton; Oyster Creek; Perry 1; Pilgrim**
  - **Various Systems / Causes**
- **1 Plant in Emergency Preparedness Cornerstone:**
  - **Fermi - Failure to Maintain Effectiveness of Site EP**

Inspection Findings (S&RP)

- **White at Grand Gulf 1 (IE)**
  - Parallel Performance Indicator White Inspection Finding.
  - PI = Unplanned scrams per 7000 hours
  - Inadequate and Weaknesses in response to White Performance Indicator reported by licensee in 3rd QTR 16.
  - **Poor Root Cause Analysis**
- **White at Saint Lucie 1 (IE)**
  - Failure to maintain configuration control of the Unit 1 main generator inadvertent energization lockout relay circuitry.
  - Resulted in reactor trip and loss of offsite power (LOOP) on August 21, 2016.
  - 2E-6 change in core damage frequency (ΔCDF).

Inspection Findings (S&RP)

- **White at Catawba (MS)**
  - Failure to adequately develop and adjust preventive maintenance activities in accordance with procedure.
  - Failed to develop preventive maintenance strategies which considered operating experience for the emergency diesel generator (EDG) excitation system.
- **White at Clinton (MS)**
  - Failure to evaluate the change in the dropout voltages for replacement relays associated with the Div. 1 EDG Room Vent Fan.
  - Change in dropout voltages prevented the fan from operating during an under voltage condition,
  - Division 1 EDG became inoperable.

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CY2017 ROP Inspection Findings (S&RP)

- **<u>White at Oyster Creek (MS)</u>**
  - Tech Spec violation - failure to follow the electromatic relief valve (EMRV) reassembly instructions, which caused the 'E' EMRV to be incorrectly reassembled.
  - 'E' EMRV was determined to be inoperable for greater than the technical specification allowed outage time.
  - Supplemental 95001 Inspection completed Sept 17
- **<u>White at Perry 1 (MS)</u>**
  - Failure to evaluate the effects of voltage suppression diode failure on the Standby Diesel Generator (SDG) control circuit.
  - Introduction of new components (diodes) into the control circuitry resulted in the eventual failure of the SDG control circuit.
  - SDG inoperable and unable to start.

Inspection Findings (S&RP)

- **White at Pilgrim (MS)**
  - Failure to identify, evaluate, and correct a significant condition adverse to quality associated with the ‘A’ safety/relief valve (SRV).
  - Failed to correct the ‘A’ SRV’s failure to open upon manual actuation during a plant cool-down on 2/9/13, following a LOOP event.
  - Subsequent 1/27/15 failure of ‘C’ SRV could have been avoided.
  - Supplemental 95001 - collective issues associated with the root cause evaluation represented a significant weakness.
  - Supplemental 95003 (May 17) for different purpose extended to cover this finding.

Inspection Findings (S&RP)

- **White at Fermi (EP)**
  - Failure to maintain the effectiveness of the EP and use adequate methods, systems, and equipment for assessing and monitoring actual or potential offsite consequences of a radiological emergency.
  - Failure to accurately analyze the effect of increasing background radiation on the site's Standby Gas Treatment System (SGTS) accident range radiation monitor (AXM)
  - As configured, the AXM would provide inaccurate indications of radioactive releases that are used as the licensee's basis for determining EAL classification and development of PARs.

Inspection Findings(S&RP)

- **No More Yellow Findings**

- **Whites - Reduced to 4 Plants**
  - **Only 1 New Finding since 4th QTR 2017**
  - **Mitigating Systems Cornerstone:**
    - **Davis-Besse**

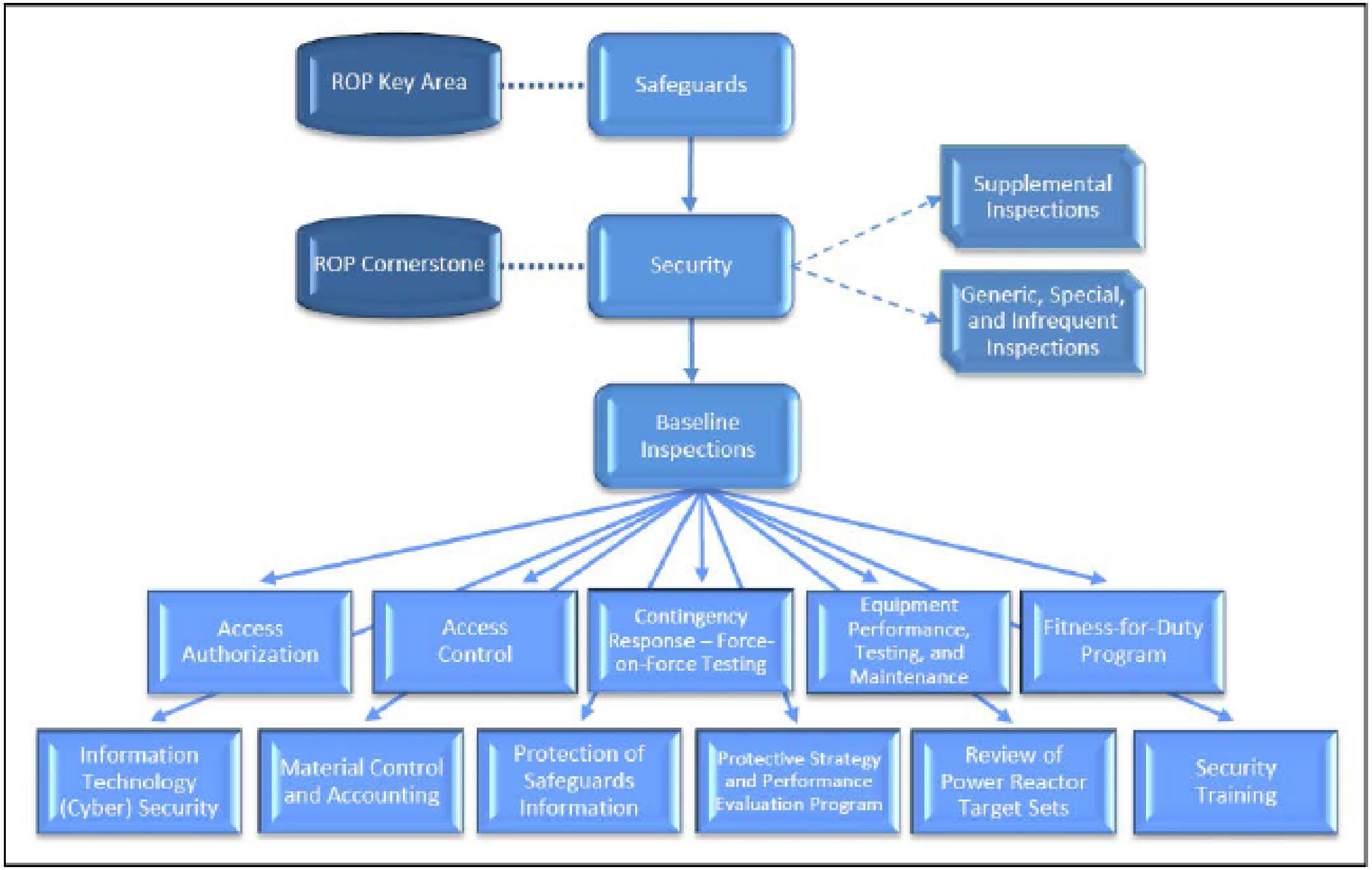
Inspection Findings (S&RP)

- **White at Davis-Besse (MS)**
  - Failure to provide appropriate instructions to maintain adequate oil in auxiliary feedwater turbine bearing oil sumps.
  - Led to failure of auxiliary feedwater pump.
  - Pump found to be inoperable for > tech spec limit.

CY2017 and MY18 ROP

Security Cornerstone

Figure 2 Inspectable Areas of the Security Cornerstone



CY2017 and MY18 ROP

Inspection Findings – Security Cornerstone

- Plants Greater-Than-Green; 4 in CY16; 6 in CY17; 3 in MY18   (not including Force-on-Force)

- GTG is not a “new” category, it means the finding was either white, yellow, or red

- Details are SUNSI and not publically available

- But NUREG-1885 - Annual non-SUNSI report provided to Congress

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CY2017 ROP

Security Cornerstone

Baseline Inspection Findings

Table 2: Calendar Year 2017 Security Inspection Summary for Commercial Nuclear Power Reactors (without Force-on-Force)

215	Total number of security inspections conducted
106	Total number of inspection findings

98	Total number of Green findings
3	Total number of greater-than-Green findings
5	Total number of SL IV violations
0	Total number of greater-than-SL IV violations

Table 3: Calendar Year 2017 Security Inspection Summary for Category I Fuel Cycle Facilities (without Force on Force)

15	Total number of security inspections conducted
4	Total number of inspection findings

4	Total number of SL IV violations
0	Total number of greater-than-SL IV violations

CY2017 ROP

Security Cornerstone - Inspection Findings

Force – on – Force Exercises

Table 1: Calendar Year 2017 Force-on-Force Inspection Program Summary

19	Total number of inspections conducted (two exercises per inspection)
34	Total number of effective exercises
0	Total number of indeterminate exercises
3	Total number of marginal exercises
1	Total number of ineffective exercises
0	Total number of canceled exercises
9	Total number of inspection findings
9	Total number of Green findings
0	Total number of greater-than-Green findings
0	Total number of SL IV violations
0	Total number of greater-than-SL IV violations

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CY2017 ROP

Force-On-Force Exercises

- **No Greater-than-Green Findings**

- **1 Ineffective Exercise:**
  - **Licensees' inability to demonstrate an effective implementation of its protective strategy to defend designated target set components**

- **3 Marginal Exercises:**
  - **In all three cases, licensees neutralized the adversary at a location, or in preparation to enter a location, that contained a single element target set.**

- **Licensees all took appropriate corrective actions.**
  - **Policy and procedure changes**
  - **Physical security upgrades and technology improvements**
  - **Personnel or security force enhancements**

Cross-Cutting Issues

- **NRC evaluates whether cross-cutting issues exist at NPPs 2x/year: at mid-cycle and end-of-cycle assessments:**
  - **No New Open Issues in 2017**
  - **No Data reported yet for mid-cycle 2018 assessments**

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CY2017 and MY18 ROP

Safety Cornerstone	Performance Indicators
#1 Initiating Events	• Unplanned reactor shutdowns, or "scrams" (automatic and manual) • Complicated unplanned shutdown • Unplanned events that result in significant changes in reactor power
#2 Mitigating Systems	• Safety system availability and reliability • Safety system failures
#3 Barrier Integrity	• Fuel cladding (measured by radioactivity in reactor cooling system) • Reactor cooling system leak rate
#4 Emergency Preparedness	• Emergency response organization drill performance • Readiness of emergency response organization • Availability of notification system for area residents
#5 Occupational Radiation Safety	• Unplanned radiation exposures to workers
#6 Public Radiation Safety	• Effluent releases requiring reporting under NRC regulations and license conditions
#7 Security	• Security system equipment availability

CY2017 and MY18 ROP

Performance Indicators

- Green: performance within an expected level where all cornerstone objectives are met
- White: performance outside an expected range of nominal utility performance but related cornerstone objectives are met
- Yellow: related cornerstone objectives are met, but with a minimal reduction in safety margin
- Red: significant reduction in safety margin in area measured by the PI

CY2017 ROP
Performance Indicators

- NO Plants with Red or Yellow
- Two Plants with White

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CY2017 ROP

Performance Indicators

IE04 - Unplanned Scrams with Complications

- Columbia Generating Station

White Threshold > 1.0			
1Q	2Q	3Q	4Q
1.0	1.0	2.0	1.0

- Unplanned scrams with complications occurred in 4th QTR 16 and 3rd QTR 17

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CY2017 ROP

Performance Indicators

IE01 - Unplanned Scrams per 7000 Critical Hours

- **Watts Bar 2**

White Threshold > 3.0			
1Q	**2Q**	**3Q**	**4Q**
NR	NR	1.4	**3.1**

NR = Watts Bar 2 went online October 2016. Significant critical hours to require reporting not reached until 3Q17.

MY2018 ROP

Performance Indicators

No Red, Yellow or White

Thru first two quarters Of 2018

CY2017 and MY18 ROP

ROP Action Matrix

Inspection Findings

+

Performance Indicators

=

Plant Assessment

ROP Action Matrix Assessment

- **Column 5: Unacceptable Performance**
- **Column 4: Multiple/Repetitive Degraded Cornerstone**
- **Column 3 Degraded Cornerstone**
- **Column 2: Regulatory Response**
- **Column 1: Licensee Response**

CY2017 and MY18 ROP

ROP Action Matrix Asessment of Plant Performance	NRC Response
Column 5. **Unacceptable Performance**	**Response at Agency Level** • Meeting with NRC Executive Director for Operations and senior plant management • Order to modify, suspend, or revoke license
Column 4. **Multiple/Repetitive Degraded Cornerstone** Repetitive degraded cornerstone, multiple degraded cornerstones, or multiple **YELLOW** inputs, or one **RED** input	**Response at Agency Level** • Meeting with NRC Executive Director for Operations and senior plant management • Plant operator improvement plan with NRC oversight • NRC team inspection focused on performance issues at the site • Demand for Information, Confirmatory Action Letter, or Order
Column 3. **Degraded Performance** One degraded cornerstone (three **WHITE** inputs or one **YELLOW** input in a cornerstone) or three **WHITE** inputs in any strategic area	**Response at Regional Level** • Meeting with NRC regional management and senior plant management • Plant operator self-assessment with NRC oversight • Additional NRC inspections focused on cause of degraded performance
Column 2. **Regulatory Response** No more than two **WHITE** inputs in a strategic area	**Response at Regional Level** • Meeting with NRC and plant management • Plant operator corrective actions to address **WHITE** inputs • NRC inspection to follow up on **WHITE** inputs and corrective actions
Column 1. **Licensee Response** All performance indicators and cornerstone inspection findings **GREEN**	**Normal Regional Oversight** • Routine inspector and staff interaction • Baseline inspection program • Annual assessment public meeting

Increasing Safety Significance

Increasing Regulatory Oversight

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CY2017 ROP

ROP Action Matrix Assessment

	Number of Plants in Each Column (per QTR)				
2017	Col 1	Col 2	Col 3	Col 4	Col 5
QTR	Licensee Response	Regulatory Response	Degraded Cornerstone	Multiple/Repetitive Degraded Cornerstone	Unacceptable
1	82	16	0	3*	0
2	84	14	0	3*	0
3	86	12	0	3*	0
4	89	9	0	3*	0

* Arkansas 1 & 2, and Pilgrim

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ROP Action Matrix Assessment

	Number of Plants in Each Column (per QTR)				
2018	Col 1	Col 2	Col 3	Col 4	Col 5
QTR	Licensee Response	Regulatory Response	Degraded Cornerstone	Multiple/Repetitive Degraded Cornerstone	Unacceptable
1	95	5	0	1*	0
2**	x	x	x	x	x
3	x	x	x	x	x
4	x	x	x	x	x

* Pilgrim

** 2^{nd} QTR 2018 Action Matrix Summary data not posted on website yet, most Mid-Year Assessment letters are available.

Action Matrix Summary Highlights

- **Arkansas Nuclear 1 & 2 – Back in Column 1 in 2018 after being in Column 4 since 1st QTR 2015**

Action Matrix Summary Lowlights

- **Pilgrim** 1 – **6** consecutive QTRs in Col. 3 (starting 4th QTR 2013) followed by **13** consecutive QTRs in Col. 4 since then.
  - NRC "muted" response considers Pilgrim plans to shutdown.

- Grand Gulf 1 – 8 consecutive QTRs in Col. 2 (started 3rd QTR16 – back in Col 1)
- Clinton – 4 consecutive QTRs in Col. 2 (starting 3rd QTR17 – remains in Col. 2) *
- Columbia – 4 consecutive QTRs in Col. 2 (all 4 QTRs of 2017 – back in Col 1)

* Supplemental Inspection conducted September 18, 2018.

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CY2016 & 17 FFD

Fitness for Duty

- **Electronic Reporting since 2009**
- **Summary Reports available from some licensees**
- **No Industry-Wide Summaries being prepared as in the past**
- **NRC staff provides annual briefing to Drug Testing Advisory Panel**

- **Tests conducted on licensee and C/V employees**

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Fitness for Duty

- **5 Types of Tests Conducted:**
  - **Pre-Access** (applicants for employment)
  - **Random** (unscheduled/unannounced for employees)
  - **For Cause** (behavior of, or information received about employee)
  - **Post-Event** (after an event involving human error)
  - **Follow-up** (after a positive test)

Fitness for Duty Data (2008-2014)

- **Three Multi-year Trends were being tracked:**
  - **Subversion attempts prevalent since CY2011 (18 to 21% of violations: 143 to 187 events per year) with 54 to 66% of sites reporting at least one.**
  - **Amphetamine positive results increasing since CY2008 (from 3.8% (in 2008) to 10.6% (in 2014) of drug & alcohol positives.**
  - **Reactor construction sites have higher positive rates, primarily in pre-access and random tests, and have higher incidence of subversion attempts than operating reactor sites.**

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Fitness for Duty Data (2008-2014) (cont)

- In February 2017, the NRC staff submitted a proposed rule to the Commission (SECY-17-0027) for consideration.
- The proposed rule, in part, would address those three multi-year trends by lowering the testing cutoff levels for amphetamine and methamphetamine, and expanding testing measures related to subversion attempt detection.
- No Commission Response yet.

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- MEANWHILE - **Subversion attempts prevalent since CY2011 continue to rise**

- <u>Subversion Attempt Trends:</u>
  - 2012 – 177 of 1,114 violations (15.8% subversions)
  - 2013 – 148 of 1,007 violations (14.7% subversions)
  - 2014 – 187 of 1,133 violations (16.5% subversions)
  - 2015 – 232 of 1,200 violations (19.3% subversions)
  - 2016 – 304 of 1,164 violations (26.1% subversions)
  - 2017 – 298 of 1,143 violations (26.1% subversions)

- <u>Subversion Attempts in 2017</u>:
  - 45 facilities with at least 1 subversion attempt
  - 67% identified at Pre-Access testing (200 of 298)
  - 98% by contractor/vendors

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Fitness for Duty Data (cont.)

- **Overall industry positive rate CY17 = 0.77% (0.76% in CY16)**
  - **Low, but continues upward trend since CY12 and 13 (both were 0.62%)**

- **Total tests in CY2017 decreased by 3.6%**
  - **Tests in CY2016 decreased by 5.9% from CY2015**
  - **Continuing downward trend**

- **Approx 64% of CY17 positives and refusals occur at pre-access**
  - **Prevents access, directly protecting public health and safety**
  - **Almost constant percentage (65%) for several years**

– **Random testing CY17 identified 22.7% of substance users**
  - **Identifies more employees using substances than pre-access**
  - **22.3% in CY2016; Continues upward trend since 2014**

CY2016 & 17 FFD

Fitness for Duty Data (cont.)

- **For cause testing continues to have highest positive rate (9.9%)**
  - **(But is trending down 13.40% in CY13, 12%in CY14; 6% in CY16)**

- **Three substances continue to account for ≈85% of positives**
  - **Marijuana (≈ 50%), Alcohol (≈ 23%), Cocaine (≈ 12%)**
  - **Amphetamine positives continuing upward trend, now nearly same percentage as cocaine.**
  - **Cocaine positives way down from high in 2006, but trending up again.**
  - **Opiate positives way down (only 1% in CY 2017))**

Fitness for Duty Data (cont.)

- **Events concerning individual employee violations must be reported to NRC within 24 hours**
- **33 <u>24-hour</u> reportable events in 2017**
  - **15 involved Supervisors/Managers**

2017 Abnormal Occurrence Report

Annual Abnormal Occurrence Report to Congress

- **No AOs at NPPs**
- **11 AOs at Medical Facilities**
- **1 Significant Event that does not meet definition of AO:**
  - **Exposure at National Institute of Standards and Technology (NIST), Gaithersburg MD**

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Questions ?

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Reactor Oversight Process Updates

Anticipating Degrading Licensee Performance
Reactor Oversight Process Enhancement Proposals

ACRS Full Committee

Greg Bowman and Tom Hipschman, NRR/DIRS
October 4, 2018

Background

- The Reactor Oversight Process (ROP) is designed to identify declining licensee performance prior to loss of reasonable assurance of adequate protection
  - Columns 2-4 of the Action Matrix provide this “buffer”
  - 9500x procedures guide the associated agency response
- That notwithstanding:
  - ACRS and others have wondered about “leading indicators”
  - The Commission has, in various forums, encouraged the staff to continue thinking about this topic
  - We routinely evaluate the effectiveness of the ROP (e.g., the annual self assessment) and seek to continually improve

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Previous Discussions

- Various discussions have highlighted ideas such as:
  - Trend in the # of findings
    - Green findings
    - Quality assurance / Appendix B-related findings
    - Maintenance Rule-related enforcement actions
  - Plant operations:
    - Work management
    - Material condition of the plant
    - Trend in unplanned outage rate relative to industry average
    - # of off-normal procedure entries
    - # of unplanned Limiting Condition for Operation (LCO) entries
    - Staffing resources
  - Trend in # of conditions requiring NRC notification (50.72/50.73)
    - Nature of these conditions (i.e., atypical?)
  - Industry (e.g., INPO) evaluations
  - Leadership performance

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Examples of Tailoring the Existing ROP

- A related point is how NRC adjusts the inspection program for plants that are:
  - Experiencing financial issues
  - Nearing cessation of permanent operation
- Inspection Manual Chapter (IMC) 2515, Appendix G
  - Provides inspection guidance for inspecting plants that are approaching shutdown and decommissioning
- Staff also utilizes a handful of means for addressing these situations:
  - Safety culture initiatives
  - Supplemental guidance memos to address specific cases
  - IMC governing resident activities calls out material condition and long-standing issues
  - Sample selection for inspection procedures that cover areas where financial difficulties could translate to degradation of performance (e.g., P&IR, Maintenance Effectiveness, Equipment Alignment)
  - Increased NRC management presence

Enhancing the Reactor Oversight Process

- NRC has a number of initiatives ongoing to make the ROP more effective and efficient. Examples include:
  - Improvements to the inspection report development process
  - Initiative to improve the minor/more-than-minor component of the issue screening process
  - Work to improve the NRC's engineering inspection program
- DIRS received input from stakeholders as part of the ongoing agency initiative associated with transformation:
  - ~70 recommendations from the internal stakeholders related to potential enhancements to the ROP
  - NEI publication and NRUG letter with initial industry proposals to improve the ROP
  - Follow-up letter from NEI with consolidated industry proposals

Internal Stakeholder Feedback

- The Transformation Team provided DIRS with consolidated stakeholder feedback related to ROP transformation.
- The feedback generally fit into several categories:
  - Changes to organization and staffing supporting oversight, primarily regional changes
  - Changes to frequency of inspections and focus of inspection procedures
  - Changes to make performance indicators more effective
  - Changes to the various components of the assessment process
  - Changes to make the enforcement program more risk-informed
  - Changes to streamline or eliminate inspection reports
- No assessment was done of the proposals; the input to consisted of direct feedback provide by NRC staff.

Recent Industry Feedback

- NEI letter submitted on September 19 (ML18262A322) and discussed at September 20 ROP public meeting
- Acknowledgment that the ROP remains a sound and effective oversight program.
- Provided some recommendations on how the ROP could be enhanced:
  - Impact of White findings (e.g., press releases, labeling and communication, type of inspection follow-up)
  - Reassess baseline inspection program (e.g., focused evaluation of inspection areas, reduce burden of MSPI)
  - Improvements to the SDP (e.g., improve specific SDPs, address differences in NRC and licensee models)
  - Resolution of inspection issues (e.g., communication of potential issues, resolution of low risk compliance issues)

Next Steps

- Establish working group(s) to obtain stakeholder input, evaluate proposals, develop recommendations.
  - Initial kick-off meeting took place on October 3
- Establish recurring discussion at monthly ROP public meetings, with separate focused public meetings on specific ROP enhancements.
  - Planning public meetings on October 18 and November 15 (tentative)
- Commission approval will be needed for any significant changes to the ROP, per Management Directive 8.13.