Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Thursday, April 7, 2016

Work Order No.: NRC-2302 Pages 1-214

NEAL R. GROSS AND CO., INC.
Court Reporters and Transcribers
1323 Rhode Island Avenue, N.W.
Washington, D.C. 20005
(202) 234-4433

DISCLAIMER

UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The contents of this transcript of the proceeding of the United States Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, as reported herein, is a record of the discussions recorded at the meeting.

This transcript has not been reviewed, corrected, and edited, and it may contain inaccuracies.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

633RD MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

THURSDAY

APRIL 7, 2016

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:32 a.m., Dennis C. Bley, Chairman, presiding.

COMMITTEE MEMBERS:

DENNIS C. BLEY, Chairman
MICHAEL L. CORRADINI, Vice Chairman
PETER RICCARDELLA, Member-at-Large
RONALD G. BALLINGER, Member
CHARLES H. BROWN, JR. Member
DANA A. POWERS, Member
HAROLD B. RAY , Member
JOY REMPE, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

DESIGNATED FEDERAL OFFICIAL:

CHRISTOPHER BROWN

PETER WEN

ALSO PRESENT:

STEVE BLOSSOM, STP*

AL CSONTOS, NMSS

KRISTOPHER CUMMINGS, NEI

STEVEN DOLLEY, Public Participant*

TIMOTHY DRZEWIESCKI, NRO

DARRELL DUNN, NMSS

RUSSEL FELTS, NRR

CJ FONG, NRR

STEPHEN GEIER, NEI

ANNE-MARIE GRADY, NRO

PHIL GRISSOM, SNC

WAYNE HARRISON, STP*

MICHELLE HART, NRO

THOMAS KINDRED, Westinghouse

ROBERT KITCHEN, Duke Energy

STEVEN LAUER, NRR

MARK LOMBARD, NMSS

JOHN McKIRGAN, NRO
MALCOLM PATTERSON, NRO
ANDREW PFISTER, Westinghouse
PAUL PIERINGER, NRO
ROBERT ROCHE-RIVERA, NRO
STEPHEN SMITH, NRR
BOYCE TRAVIS, NRO
ANDREA D. VALENTIN, Executive Director, ACRS
BERNARD WHITE, NMSS
EMMA WONG, NMSS
JACK ZHAO, NRO

*Present via telephone

TABLE OF CONTENTS

P R O C E E D I N G S

8:35 a.m.

CHAIRMAN BLEY: The meeting will now come to order. This is the first day of the 633rd meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the Committee will consider the following: AP1000 generic design changes, Regulatory Guide 1.229, spent fuel storage and transportation, and preparation of ACRS reports.

The meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Mr. Peter Wen is the Designated Federal Official for the initial portion of the meeting.

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

There will be a telephone bridge line, and it sounds as if there is. And if we can get that -- okay. Thank you. There is a telephone bridge line.

To preclude interruption in the meeting, the phone will be placed in the listen-in mode during the presentations and committee discussion. Sounds like we've done that -- no, not yet.

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

I also wanted to make you aware that this meeting is being webcast with the ability to view our presentation slides on the web.

Those of you on the bridge line who may want to do that, can dial into the bridge line or connect through the NRC's public meeting website and click on the link.

This does work and everyone who I've heard from says the sound is much better there than on the bridge line. So, it's recommended. If you have trouble, please call our office.

The Committee would like to introduce and welcome four invited subject matter experts; Dr. Margaret Chu, Walt Kirschner, Jose March-Leuba -- they're all here, he's over here -- and Matt Sunseri.

At this time, we'll continue with the meeting and I think Harold is up first, right? AP1000. Harold, that's yours.

MEMBER RAY: Thank you, Mr. Chairman.

As you say, our agenda refers to this as AP1000 Generic Design Changes. You will find that the presentations, though, indicate more precisely that they are changes that are being proposed for the Levy Nuclear Plant COLA. They are generally applicable, but we will be discussing the application to Levy today.

We had a full-day subcommittee meeting on April 5th, just two days ago, and we, therefore, obviously had the benefit of more information that will be -- than will be presented here today.

We also had the benefit of the participation of our consultant, Dr. Bill Shack. Bill has been very aggressive in turning around a draft of his report to us already. But because of the short time frame, he will be able to participate as he wishes, or as any of the members may wish to inquire from him, on a phone line that's been established for that purpose here today.

We will be hearing from the AP1000 certificate holder, Westinghouse, and their -- the COLA applicant, Duke Energy, as well as from the staff. And we'll hear from the applicants initially, but I'd like first to give a chance for the staff to make any opening remarks that they wish to make.

And so, John McKirgan will please do that for us.

MR. MCKIRGAN: Thank you, Committee Sub-chair Ray and members of the Committee. I'm John McKirgan. I'm Chief of Licensing, Branch IV, the AP1000 Licensing Branch. I'll be very brief, because I know we want to reserve a great deal of time for the presentations.

I wanted to thank the Committee and especially extend thanks to Subcommittee Chair Ray and the ACRS staff, Peter Wen.

The Committee made exception and accommodated the staff greatly in the scheduling of the subcommittee meeting on the 5th and we very much appreciate that.

The staff's been working very diligently to finish our SER for the Levy application as we move towards completing that review activity and the subsequent activities that will follow potentially culminating in a mandatory hearing. So, I do wish to appreciate the Committee's indulgence of us.

We're looking forward to some very good presentations today. We've had a great deal of interaction at the full-day subcommittee. the staff will move very agilely and efficiently, hopefully, throughout presentation materials.

And with that, I'll turn it back to you, Mr. Ray.

MEMBER RAY: Thank you, John. Terminology may be a challenge for us at times here, because we've got -- in some measure we're allowing new grounds for many of us, anyway.

I made reference to the fact that these are called "generic changes," but actually they're for Levy specifically here. They are referred to as "design changes." You'll hear them also referred to as "departures." There's one other term that comes up from time to time, it's "exemption."

I recommend you don't let any of those different terms and others that may seem a little confusing bother you. But if you have any questions, just ask.

There are five exemptions which include six departures, and that will be elaborated, I think, in the staff presentation.

Anyway, with that, we should begin and I'll ask Mr. Kitchen and whoever else he wishes to bring to the front table, please, and to begin their presentation to us.

(Pause.)

MR. KITCHEN: Good morning, again. I'd also like to express appreciation to the ACRS for this important, quick turnaround here to get us in front of the full committee.

As John and Mr. Ray indicated, we spent the full day Tuesday going through the items we're going to discuss today in more detail, obviously, than we will plan to do or had the time to do today.

I'm Bob Kitchen, Licensing, Duke Energy. We have Andy Pfister, who's the Manager of Systems Integration with Westinghouse. And Tom Kindred, who is a Fellow with Systems Integration at Westinghouse as well.

So, we're going to step through the material and cover the items that we're implementing as changes. As Mr. Ray indicated, these are all departures and also exemptions.

The condensate return we'll talk about first. Condensate return is a change to -- that affects the passive arch or cooling capability of the AP1000.

We needed to make a design change. As was discovered during the review of the Westinghouse AP1000 in the United Kingdom, there were questions about how much condensate return and how do you know?

And in looking into that in depth, it was determined that the previously estimated amount was not accurate. In fact, it was considerably lower. So, there needed to be changes to meet that assumption that were required to support the design, which affected primarily the ability to get to 420 degrees in 36 hours and, also, as you'll see, the long-term operation of the system.

The impact of that was significant in that it resulted in the inability to meet the licensing basis, but it does not result in an inability to meet the function of the system since we could use ADS and open loop cooling to meet the cooling requirements of GDC-34.

The change really amounts to, as you would imagine, design changes in hardware to increase the collection of condensate and improve the routing of the condensate back to the in-containment refueling water storage tank, or IRWST, which included downspouts, gutters and some interference routing to reduce interference and improve the condensate collection and return.

So, again, the reason for the change is that we couldn't meet the licensing basis without implementing those changes.

Looking briefly at what are the requirements, the requirements are described in

Regulation GDC-34 specifically.

As you can see here, the requirement is that the system have enough capability to remove heat to protect the fuel and the reactor coolant system boundaries. And that's the fundamental requirement, of course, to the redundancy of the system provided by the close loop end/open loop portions. And the open loop portion was never affected.

There was also a SECY, which is a staff policy, Commission policy, on safe shutdown. And in that SECY, which is specifically 94-084, it describes 420 for passive plants as being determined to be a safe, stable condition.

As it goes on to describe, it's not the only condition. There could be -- in fact, there have been a variety of conditions that have been used for safe shutdown. So, there are other conditions that would meet the requirements of safe shutdown.

And specifically, also, the criteria for safe shutdown and the passive system capabilities could be demonstrated by safety analysis and that show the system's capability to meet that requirement and how it would protect, as we mentioned earlier, the fuel and reactor coolant system boundary.

The problem also is that the DCD Revision

19, which of course is the certified design in Part 52 appendix D, had some inconsistencies in it. There were descriptions in the certified design under design basis -- safety design basis that stated that it could cool to 420 in 36 hours.

And also that there were statements in the DCD that the system performance could be maintained for an indefinite period. Extremely bad choice of words, but "indefinite" of course implying that so long you don't need to worry about it.

We needed to revise that to reflect correctly what is the safety design requirement, functional requirements for that system performance, and also clarify and specify what the duration was for long-term operation. And as you'll see, we determined that was 14 days duration, at least.

There were a number of issues addressed on how this was being evaluated. As this thing evolved and we worked through it, Westinghouse basically stepped back, which was a very good thing, stepped back and said, let's reconsider how we're doing the calculations and evaluations that support the system design basis.

They really started, you might say, with a clean sheet of paper and said, how should these evaluations be done?

There were -- there was an error found. There were a series of calculations, four specifically, that involved WGOTHIC and LOFTRAN, which are computer model systems, and also interspersed in there the use of a spreadsheet hand calculation model were certain elements of that.

So, looking at that, it was determined that the spreadsheet use could be eliminated and basically have a handoff from WGOTHIC and LOFTRAN to address the consideration. So, it improved the model in terms of eliminating an unnecessary handoff.

Probably any time you've got a validated computer model that you can use instead of a spreadsheet hand calculation, that's better.

It also simplified the method. And by using LOFTRAN and WGOTHIC, these are approved safety-related codes. So, all in all an overall improvement.

There were some considerations and concerns with the use of LOFTRAN specifically in looking at the system, as we've looked at it in great detail over the period of time we've been working on this.

There were concerns raised about what the impact would be of heat loss from the components in the reactor system, most dominantly the pressurizer.

A lot of heat loss that could occur and they were concerned with what would be the impact to potentially the loss of sub-cooling in the reactor coolant system and two-phase flow situation.

And besides the concern of how do you deal with that if that occurs, specifically in the modeling the concern was the LOFTRAN doesn't model effectively and can describe in detail, but it doesn't model effectively the two-phase flow situations.

VICE CHAIRMAN CORRADINI: Can I ask a question somewhere in here about the experiments that are the basis of this?

So, for the parasitic losses when we were together at the subcommittee, you indicated that experiments -- recent experiments were done to try to get a feeling for the actual parasitic losses, versus what you guys are conservatively assuming.

So, is -- just to be clear, those are mainly from support plates and beams primarily?

MR. KITCHEN: (Shakes head.)

VICE CHAIRMAN CORRADINI: So, are those designs fixed --

CHAIRMAN BLEY: I'm sorry, we need words for the transcript.

(Laughter.)

MR. KITCHEN: That's correct.

MR. PFISTER: That's correct.

VICE CHAIRMAN CORRADINI: Oh, good.

So, are those designs of those support plates and beams finalized enough that you can then make the connection between what you measure and then what you conservatively bound in the calculation so that there's not going to be a change in the design and then potentially a change in the data?

MR. PFISTER: That's correct. And so, one of the things that I talked about on Tuesday is we looked at this from interface control perspective.

And one of the root causes to this issue and some of the others were how we're controlling the interface between physical plant design and the global plant analyses such as this.

So, one of the things we've done in completion of this modeling and analysis is put in an allotment for future potential attachment plates that could be added to the containment vessel to conservatively bound where we think we'll end up.

And what we do is, we manage that allotment very closely between our system designers and our mechanical designers. So, we have a positive control mechanism in place, you know, to make sure we're constantly watching that, you know.

One of the other things, and Bob touched on it very briefly and -- when he talked about the physical design changes that had been implemented, is for -- we actually went and rerouted some hydrogen sensors and the cabling that was associated with that to remove those attachment plates from the vessel to further help, you know, promote a higher return rate.

VICE CHAIRMAN CORRADINI: So, it's not just a change in design, but you also have an allotment about numbers.

MR. PFISTER: Correct.

VICE CHAIRMAN CORRADINI: Okay. All right. Thank you.

MR. KITCHEN: Okay. So, we did do a review of the impact of heat loss. There was a comparison using LOFTRAN with another code, which is not fully qualified to be used, you know, as a safety basis code, but the RELAP5 code was used to do -- as a validation of the heat loss impact, because the RELAP code models the two-phase flow effectively.

And the conclusion then, conservatively, that the LOFTRAN was appropriate to use, which -- assuming adiabatic conditions.

Also in response to staff request typically the design basis accident analysis terminates when you reach a stable condition. And for these, it was, you know, in the neighborhood of six to 12 hours and that analysis terminated depending on what you were looking at.

So, the staff requested that we extend that analysis out for the full 72-hour duration required by the regulation to the -- for the accident analyses. And that was done and proved that the system performance met requirements.

The other thing was the determination of safe shutdown to reach 420 in 36 hours. And as it was done for DCD Revision 19, that analysis was done using a -- we use the term "conservative non-bounding," "best estimate," more realistic, whatever terminology is -- you feel most comfortable with, but basically a conservative, non-bounding analysis to show that we could reach 420 in 36 hours and maintain that.

Then the question was how long? And in our -- we defined that duration in our application as greater than 14 days. I believe the analysis actually shows it much longer than that, but a 14-day duration for a long-term operation is certainly adequate. And then we also looked at operational impacts and recovery.

So, that's where we're at in terms of the changes regarding condensate return and those are reflected, as Mr. Ray indicated, in the Levy Final Safety Analysis Report, the COLA that we've submitted.

And the conclusion is in the separation that we've made, is to show that under design basis analysis assumptions the system can maintain the plant in a safe, stable condition meeting the GDC-34 regulatory requirements for at least 72 hours.

And that with a conservative, non-bounding analysis we can demonstrate 420 in less than 36 hours for at least 14 days. And that the use of the LOFTRAN for -- with adiabatic assumptions is appropriate.

So, this just compares what's in DCD Revision 19 as compared to what we have in the Levy FSAR. And you can see it's just a -- it really repeats what I've already said, but the intent here is just to show you one graphical or tabular format, what has changed in the Levy FSAR relative to the certified design.

That's all we're going to cover on condensate return, unless there are questions, and then we'll go through the other changes that we have. Andy is going to --

MR. PFISTER: Yes.

MR. KITCHEN: First, we're going to cover, I think, the testing with regard to --

MR. PFISTER: As a follow-up to Tuesday's questions, we did put a few slides in here to cover what we're calling our Phase 1 and Phase 2 testing. And so, my colleague, Tom Kindred, is going to spend a few minutes to walk through that.

MR. KINDRED: So, as we discussed on Tuesday, the Phase 1 testing was a long section of the containment vessel coated with an inorganic zinc coating. It had a film distribution system at the top of the plate to develop a uniform film flow.

The film was allowed to flow down the length of the plate and encounter weld seams, the attachment plates, beams, structural supports, et cetera, that are in the plant geometry that would be responsible for the parasitic losses that we use to determine the 18 percent loss on the containment vessel shell. We did conduct that testing over the range of plant film Reynolds numbers.

And then for the dome rainout phenomena, the losses there were taken from the literature and we assumed a hundred percent loss for inclination angles less than or equal to 12 degrees.

Next slide. So, we did the -- we developed a Phase 2 test facility as well. This facility, it's important to know, was not utilized. It was not utilized to justify the analysis assumptions in the licensing submittal.

The facility was really -- we developed the test facility and the test program, because we believed there was a lot of margin in what we had done for the Phase 1 testing and we kind of wanted to capture that for future improvement efforts.

The facility was an 8.5-foot diameter, 16-foot height, steel containment vessel. It had a rated pressure of approximately 60 psi gauge, which is consistent with AP1000 and 59 psi gauge. The rated temperature was approximately 310 degrees. AP1000 was 300 degrees.

So, we had a pressure and temperature scale test facility that was indicative of the AP1000 design conditions.

VICE CHAIRMAN CORRADINI: This is the upper -- this models the upper dome region above the deck?

MR. KINDRED: Yes, and the side walls. It had actually a plate on the inside that could be manipulated so the inclination angle could be controlled during the experiment so you could change it from zero all the way up to 90.

VICE CHAIRMAN CORRADINI: Okay.

MR. KINDRED: The plate also -- what we did, the plate actually was -- had a labyrinthine backing on it so we could provide through a header system cooling flow into the backside of the plate so that we could -- and then we could measure MDOT and do an energy balance to ensure we had achieved --

VICE CHAIRMAN CORRADINI: That seems familiar.

MR. KINDRED: Yeah, it does. I'm sure it does. I mean, yeah, so we could make sure we got the prototypic surface fluxes for the film behavior.

What we believed was that when we got to elevated temperatures, that the -- so, the Phase 1 testing was done at rather colder conditions with temperature ranges between 70 and 120 degrees Fahrenheit.

What we believed when we went to elevated temperatures was as the surface tension was reduced at the elevated temperatures, you would get a reduction in the cohesive forces and you would get better wetability.

The film would have a greater tendency to stay attached to the surfaces, it would have a smaller tendency to detach, and so we would see higher -- or lower losses or higher return rates back to the IRWST as a result of this testing.

Next slide. So, what we found in the elevated temperature test, what we believed in any improvements we thought we would see, we did see.

We saw ten percent losses at the 12-degree weld seams. So, there were three weld seams in the plant on the CVF, the containment vessel upper dome. There's one at 5.8 degrees, one at 12 degrees and one at 33 degrees.

Currently, the analysis assumes, again, for all inclination angles of 12 degrees or less, a hundred percent losses. What we found was that at the 5.8-degree inclination angle at that weld seam, we did see high losses, about a hundred percent. But once we got down to 12 degrees for the heat fluxes in the range of the first 30 days of the station blackout event, we only saw about 10 percent losses.

The analysis currently assumes a hundred percent. So, we saw a 90 percent improvement in margin from that loss factor on the CV shell.

And then we saw zero percent losses for the 33-degree weld seam over the range of expected heat fluxes.

So, again, we assumed the hundred percent losses for the rainout phenomenon from the 12-degree inclination angle or less. And we also assumed that for the weld seams encountered for inclination angles less than 12 degrees.

What we did also see was that for the flat plate -- so, we ran about 209 experiments at this test facility. We had a large variability in flat plates. We looked at --

CHAIRMAN BLEY: Just hold for a minute, please.

(Audio difficulties.)

(Discussion off the record.)

CHAIRMAN BLEY: Okay. I think we're able to resume.

MR. KINDRED: Okay. So, yeah, what we saw for the flat plate test was that for inclination angles less than four degrees we did not see losses. And so, that was, again, we're assuming a hundred percent from 12 degrees. So, that was a marked improvement as well from the losses we had assumed in the analysis and based on the Phase 1 testing.

What we found -- one of the things we didn't foresee in an improvement or enhancement that occurred as a result of this was the behavior of the film.

So, in the Phase 1 testing we assumed a fully-developed film via a film distribution system. And so, there are additional phenomena that are -- exist in a fully-developed film.

You have the inertial instability or what Bancroft called the long-wave instability. It's the rippling waves that occur across the surface of the film and what gives rise to the wavy laminar classification of film flow.

When we went to the elevated temperatures and used the steam source, we did not see the existence of the long-wave instability. And so, the rivulet behavior without the long-wave instability or the inertial instability, the film had a much greater tendency to remain attached.

So, for -- in the analysis where we saw -- we assumed that when the film encountered beams and structures, that that was immediately lost. If there was a horizontal structure orthogonal to the surface of the film or to the film flow transverse, we assumed all of it was lost.

And what we found was that when we were in the rivulet regime, the rivulet seemed to meander around it. They would go around, stay attached to the film. And so, we saw for 90-degree inclinations or where the attachment plates were horizontal, which is indicative of the majority of the attachment plates on the containment vessel, we saw zero losses.

Even for the plates that had structural beams attached to them, the rivulet regime just wanted to remain attached. It probably had to do with -- or definitely had to do with the wetability of the inorganic zinc coating and the ability of the nonexistence of that inertial instability.

That inertial instability was what was causing a lot of the losses as the -- what would happen, we would watch the video of the Phase 1 testing. And as the flow fell down, you -- it was a periodic loss. And that periodicity was in the domain of that inertial wave instability.

So, when we lost it --

VICE CHAIRMAN CORRADINI: So, I have a question. Since you got into the fun details, so, you said you did in the Phase 2 testing, a myriad of experiments.

Did you repeat an experiment at the beginning, at the end, to see if the zinc oxide coating aging affected the wetability?

I'm very curious about the aging effects on the surface and how -- where it would -- I'm --

MEMBER POWERS: Especially --

VICE CHAIRMAN CORRADINI: I knew he'd say something.

MEMBER POWERS: Especially over time you're going to get carbonate on that zinc and the -- it's going to behave very differently.

MR. KINDRED: So, we did not look specifically at variability over time in this test facility. However, in the AP600 testing for the wetting, the determination of the wetting of the outside of the containment vessel, which is, again, coated in an inorganic zinc coating, we saw greater wetability with aging on the inorganic zinc coating.

We didn't look into it --

MR. SPEAKER: Is that outside, right?

MR. KINDRED: -- as scientifically why. We just -- that's what we --

MEMBER POWERS: It doesn't inspire any confidence at all, because the chemistry outside and the chemistry inside are two different things to the portal zinc and the epoxy that's binding them all together. I mean, they're just not going to see the same thing and I am -- I personally am unable to predict wetting, you know, microscopically based on what happens to it.

The way I understand, wetting is -- now, I'm hardly an authority on the subject. There may be people that can predict it. I, I mean, it seems peculiar to the chemical circumstances.

MR. KINDRED: Yes.

MEMBER REMPE: With all the different tests that you did, were there some tests that you did that were very similar that you could give us like, oh, we saw variability, two percent out of the ten percent or something like that? What was the accuracy of -- or repeatability of the results?

MR. KINDRED: So, the tests were very well controlled. The test uncertainty for the plates and the support beams, they were very well controlled.

There was a trough system that allowed basically collection of everything that got lost. And then right at the end of the structures where the film encountered an obstruction, there was a little gap where the film that remained attached could be collected and we were able to look at the ratios of the mass flow rates and the masses from what got lost to what did not get lost.

And so, we -- the uncertainty evaluation in the test reports, I believe, were around five percent.

MEMBER REMPE: Okay.

MR. KINDRED: And they were -- they did show very good repeatability and we did not have a large random uncertainty associated with the previous tests. And we did run, again, 209 tests. So, we ran many repeats.

And in the Phase 1 testing, one of the other reasons for the conservatisms and the losses was we didn't run a lot of the repeat tests. And so, we were subjected to the t-distribution uncertainties or the student distribution. So, that would, again, was another conservatism and why we ran the larger test database for the Phase 2 testing.

MEMBER REMPE: Thank you.

MR. KINDRED: You're welcome.

So, in conclusion, what we determined was that there was -- the conclusion of the Phase 2 testing were that under more prototypic conditions at the elevated temperatures that the plant would actually be in, we would have seen a marked improvement or a marked reduction in the losses in the condensate return analysis.

MEMBER SKILLMAN: Tom, would you explain

what this image is, please?

MR. KINDRED: So, this image was actually one of the -- so, one of the configurations of the plate within the containment test vessel. And this is showing -- I believe this is an inclination angle of around 46 degrees.

And it's really meant to show just the one stream coming off, but this is like what you would see, an attachment plate with a support beam attached to it representative of what we would actually see in the plant.

MEMBER SKILLMAN: So, this is a lighted image inside at some pressure and at some temperature with actual condensation flowing off of one of the ledges.

MR. KINDRED: That's correct.

MEMBER SKILLMAN: Understand. Thank you.

MR. KINDRED: You're welcome.

MEMBER RAY: Given the discussion about the potential for uncertainty or unquantified uncertainty, could you repeat again in summary the margins that exist, either you or Andy --

MR. KINDRED: Sure.

MEMBER RAY: -- as between the data that would be inferred from the test results and what is assumed in the analysis?

MR. PFISTER: Sure. So, in the analysis we assume a constant 18 percent loss of the water and steam delivered to the containment vessel.

Based on --

MEMBER RAY: And a full loss of water delivered to other surfaces --

MR. PFISTER: The full loss of water delivered to other surfaces. Based on the Phase 1 testing where we went and actually took the data and did the analysis, the max loss we were seeing is on the order of 14 and a half percent.

So, with respect to the Phase 1 testing and the submittals we made to the staff, we're seeing around three and a half percent margin.

We didn't specifically go back and try to exactly quantify the additional benefit we'd get from the Phase 2 testing, but we believe it's on the order of another three to five percent benefit.

MEMBER RAY: By "benefit," you mean additional margin?

MR. PFISTER: Additional margin. So, a reduction in that loss fraction.

MEMBER RICCARDELLA: So, with the Phase 2 testing if you took it into account, it's getting back closer to the original ten percent assumption, yes?

MR. PFISTER: Closer, but keep in mind the original ten percent assumption was 90 percent of all water that left the IRWST returned.

MEMBER RICCARDELLA: Ah.

MR. PFISTER: And, you know, we're using different terminology now, you know. This 18 percent loss fraction is water that gets to the vessel as --

MEMBER RICCARDELLA: All right. I understand.

MR. PFISTER: But later in time, yes.

MEMBER RAY: Okay. Now, we've got, as we said, we had five exemptions. This is the first one. So, we want to make sure any and all questions are answered, but otherwise we'll proceed on.

MR. PFISTER: Okay. So, I'll step through these other four issues this morning. So, the first item, post-accident main control room dose. So, it's a high-level summary statement of a problem we were trying to correct.

As part of an update to the main control room dose analysis and associated extended condition, we identified some non-conservatisms or just errors in our analysis. The biggest of which was we have a safety-related filtration unit that's located in the operator break room. And that infiltration unit was not considered as a source in our control room dose analysis.

We also identified that for our main steamline break we didn't model the most limiting scenario in terms of steam generator blowdown, which had an impact on, you know, main steamline dose analyses, as well as we identified some discrepancies in the underlying direct dose calculation. So, specifically where there had been an assumption that there was some shielding in the design that was never implemented.

So, to correct these conditions and bring the design back into compliance with GDC-19, shielding was added to the filtration unit in the main control room break area and that filtration unit was then accounted for as a source within our dose calculations.

We also looked at things such as lowering the tech spec for secondary site activity. So, you know, what we can still show as clearly bounded by plant operations to support the correction of the error associated with the main steamline break analysis. And we --

MEMBER RAY: Did that change in the tech

spec and will it have any effect on any other thing in that main control room dose calculations? One would think it would have.

MR. PFISTER: We saw no negative impact on anything else. It would have a positive impact in other places, but no adverse impact.

MEMBER RAY: All right.

MR. PFISTER: And we made a number of other, you know, detailed corrections and changes looking at things like setpoints for system actuation and whatnot.

And the sum result of all of these changes was actually a decrease in reported dose for similar events from Revision 19 of the DCD for our safety-related habitability system.

MEMBER RAY: Any questions on this exemption?

(No response.)

MR. PFISTER: All right. Second item -- or third item, hydrogen venting inside containment. And so, AP1000 has an ITAAC that's associated with a very specific severe accident scenario.

And the severe accident scenario is a DVI-line break and -- double-ended guillotine DVI-line break with a specific sequence of automatic depressurization system valve failure. So, these are failures to open.

And in this scenario, you can flood up the DVI-line and ultimately you would get a, you know, assuming a core melt subsequently, you would get a hydrogen release through the broken pipe that as it vents, will vent up through the PXS-A or PXS-B compartment, depending on where the break location is. And that hydrogen plume, that diffusion flame, could potentially challenge containment integrity.

So, what we did is we went in and did a revised analysis, you know. This was primarily driven by some physical changes in the plant configuration in those DVI compartments or really in the PXS-alpha and bravo compartments with respect to vent location. And we saw a potentially more limiting scenario based on these physical plant changes where we were potentially venting the hydrogen closer to the containment shell.

So, to reconcile this, we did a revised diffusion flame analysis and took the results of that revised diffusion flame analysis and did a containment survivability assessment. And that containment survivability assessment ultimately concluded that you have reasonable assurance of containment's survivability during this event.

And to put this a little in context based on the DCD PRA, this is a 60 to the minus nine-type event. And that number actually gets better when we've looked forward in some of the site-specific PRAs that we've done, you know, for some of the licensees.

MEMBER RAY: Well, leaving that aside, this was, though, a discrepancy that required --

MR. PFISTER: Correct. This was a discrepancy --

MEMBER RAY: Had to be addressed.

MR. PFISTER: -- that required an ITAAC revision.

MEMBER RAY: Yeah.

Okay. So, the upshot is that the assumptions that Andy's just described had to be changed from those that otherwise would have existed due to a development of the design internal to the containment, which caused the venting of one compartment to move the -- any hypothetical severe accident -- post-severe accident flame closer to the containment boundary and they've looked at that and found it acceptable.

MR. PFISTER: All right. The next item has to do with our protection of --

MEMBER POWERS: I'm a little slow here.

You did an analysis. Why did it come out okay?

MR. PFISTER: Why did it come out okay? So, this was a series of calculations. So, matrix and MAAP calculations to determine what is the source term. Based on that we did diffusion flame analysis and ultimately we took the temperature distribution from that diffusion flame analysis and did a structural evaluation.

And when we did that structural evaluation, we show we continue to meet Service Level C requirements for the containment vessel.

MEMBER POWERS: Okay. So, it comes out okay because you can -- you don't get as much heat flux on the wall, or because the wall conducts the heat far enough away that you don't get high temperatures on the wall?

MR. PFISTER: You do get high temperatures on the wall, but, you know, the stress is imposed as a result of those high temperatures don't exceed --

MEMBER POWERS: Just never got high enough to threaten any structural integrity.

MR. PFISTER: Yeah. And it's really a combination of during this event you have relatively low containment pressure. And so, even though you have high temperatures, it's a short duration burn coupled with relatively low containment pressures.

MEMBER POWERS: So, ultimately, the reason is how we define the accident and not inherent to the structure.

MR. PFISTER: And not a what? I'm sorry.

MEMBER POWERS: Not inherent to the behavior of the material. Clearly if I could define a high-pressure sequence and a long duration flame, then you get into trouble.

MR. PFISTER: Correct. But a DVI-line break, those aren't the consequences of a DVI-line break. And so, this is for one very specific accident. And so, a DVI-line break is not an event that challenges containment pressure boundary.

MEMBER RICCARDELLA: Excuse me, what is that acronym? DVI-line?

MR. PFISTER: Direct vessel injection. So, these are eight-inch --

MEMBER RICCARDELLA: Eight-inch Schedule 160 lines?

MR. PFISTER: Yeah. So, the mass and energy associated with an eight-inch break is not limiting.

VICE CHAIRMAN CORRADINI: But just to get to Dana's question, so geometrically that's the compartment that that would have -- that pushes the flow towards the wall.

MR. PFISTER: That's correct.

VICE CHAIRMAN CORRADINI: That is a compartment which has the break, which then if hydrogen is generated, would push it towards the wall --

MR. PFISTER: Yeah.

VICE CHAIRMAN CORRADINI: -- in comparison to what it used to have been in the analysis. I just want to make sure we --

MR. PFISTER: In the previous analysis if you assumed a similar or the same consequential -- the same other failures and failures in ADS, you would have still had hydrogen venting through this compartment.

Based on the previous plant configuration, that venting would have occurred farther away from the containment vessel. The view factor would have been much lower and it was even easier to demonstrate containment survivability. A structural evaluation wasn't even required.

MEMBER RICCARDELLA: But as I recall, the stresses you calculated were like 15 ksi versus an allowable of 50.

MR. PFISTER: Correct.

MEMBER RICCARDELLA: So, you probably could -- it probably could have survived a higher pressure in the containment, right, because of that margin.

MR. PFISTER: Yeah, but it's definitely, you know, depending on pressure, temperature and time. So, all three inputs need to be taken into consideration.

MEMBER RAY: Anything else?

(No response.)

MEMBER RAY: Okay.

MR. PFISTER: Okay. The next topic. flux doubling compliance with IEEE-603. So, this relates to our protection and safety monitoring system. So, our safety-related I&C system.

You know, to try to simply explain this, AP1000 has logic within the safety system to protect against flux doubling-type events.

This is a safety feature unique to the AP1000. So, you know, it's something that wasn't -- hasn't necessarily been implemented within operating fleet's safety and protection systems.

And as part of implementation of that feature, we identified that we failed to meet one of the criteria within IEEE-603 that essentially allowed -- potentially allowed an operator, you know, to block that signal without the correct permissives.

And so, this was a relatively straightforward change within our PMS logic to bring it back in compliance with IEEE-603.

All right. So, the last item, main control room heat-up. Just a little bit on the background of the problem statement for main control room heat-up, we essentially -- this issue arose because of two items. One, that as part of the detail design -- detail design of the main control room and the main control room envelope, we saw an increase in the size and quantity of equipment in that room, which caused an increase in the heat loads within the room.

We also identified, you know, a more limiting, you know, very low probability transient where you could have a loss of HVAC. So, this is our active HVAC that didn't coincide to a loss of AC power. So, an event where you lose your safety -- or you lose your active HVAC, but you still have AC power for an extended duration that's causing those heat loads to be maintained within the control room.

To reconcile that, we implemented two-stage automatic load shed in the control room. That first stage occurs simultaneously with activation of our safety-related habitability, our Victor echo Sierra system, VES.

That first load shed, sheds just small house loads. Things like, you know, kitchen appliances, coffee makers and a few of the business LAN networks. It does not shed any of the main wall panel information system within the control room.

If HVAC has not been restored within three hours, there's a second load shed that's implemented. That second load shed de-energizes those large wall panel displays which are one of the main heat sources within the control room.

And in implementation of that second load shed, all of this information that was available to the operators on those wall panel displays remains available to the operators at his RO consoles. So, the RO consoles are non-safety-related, but they continue to be powered throughout the entirety of this event.

And so, there isn't a loss of control by the operator, there isn't a loss of information that the operator has available to him during such an event.

So, ancillary things that went along with this change is we did make two tech spec changes. So, one of the tech spec changes was associated with adding temperature requirements to coincide with initial conditions in the surrounding rooms.

The initial conditions in the surrounding rooms is an input to our GOTHIC analysis that looks at control room heat-up. And we also made a tech spec change to limit moisture content in those VES tanks to eliminate any concern associated with potential freezing at the regulator.

Ultimately, the analysis demonstrates that for the first seven days temperature in the control room is maintained below a wet-bulb globe temperature of 90 degrees. And what that coincides with is an unlimited operator stay time per NUREG-0700.

And so, we're demonstrating, you know, no change, you know, no restrictions on operator stay time in the control room, as well as no loss of, you know, information or control at the RO consoles.

CHAIRMAN BLEY: And this was based, as I recall, on historical high temperatures, four consecutive day high temperatures in the Levy area; is that right?

MR. PFISTER: So, the analysis assumes that for the first 72 hours of the event, the exterior temperature, the outdoor temperature is at the max safety limit of 115 degrees. And I think that's dry-bulb -- the dry-bulb temperature. And then from 72 hours to seven days, we assume a diurnal temperature at the max safety -- at the max normal temperature. So, I think that's the one percent exceedance number of 101 degrees.

Those are standard plant values for AP1000 that each applicant is required to meet. But when you compare those diurnal temperatures for four consecutive days to, you know, max temperatures, you would see in the Levy area they do bound.

CHAIRMAN BLEY: Thank you.

MEMBER STETKAR: Andy, I -- we had a little discussion at the subcommittee meeting about the load shedding and what was shed. And I understand that -- so, I went back and reread some things.

Does the current room heat-up analysis under conditions where normal ventilation is lost, but AC power remains available, does that analysis account for shedding all of the 24-hour battery loads at 24 hours?

MR. PFISTER: It does not, because in this scenario you have AC power.

MEMBER STETKAR: Good.

MR. PFISTER: And so, you're not challenging your 24-hour batteries. They continue to be charged.

MEMBER STETKAR: And you know that?

MR. PFISTER: Yes.

MEMBER STETKAR: Okay. Thanks. Because when I read the SER, the SER seems to indicate that it does.

I know the old analysis under station blackout conditions obviously did because they went away, but the new analysis keeps those loads.

MR. PFISTER: Yes. As long as you have AC power --

MEMBER STETKAR: Yes.

MR. PFISTER: -- you're not challenging battery capacity.

MEMBER STETKAR: Right. Got it. Got it. Thank you. So, I'll ask the staff about the 24 hours. Thank you.

MR. PFISTER: I think that concludes the Duke and Westinghouse presentation.

MEMBER RAY: Well, we've got a couple minutes, so let me make a few other statements. I failed to mention that we had two subcommittee meetings in 2014 considering the first item that was mentioned, the condensate return, when it was still under development in terms of the response, the condition and so on. But during those subcommittee meetings, we asked Duke and Westinghouse to address what I'll call the cause of the condition that we were looking at then.

And at the subcommittee meeting on April 5th, both they and the staff provided a very comprehensive discussion of what then ensued not only with respect to condensate return, but also the other four things that we've talked about here relative to what was understood and learned from. And Andy made a comment about configuration control being enhanced as a result.

In any event, those -- that whole discussion of lessons learned, cause, extent of condition, applicability of QA, program requirements and so on was discussed at the subcommittee. But for reasons of time, not brought here to the full committee because it's a lengthy discussion, but it -- they did respond to that concern that was, as they say, identified a couple of years ago and pursued it. And to some extent, these five things all then are a consequence of looking at issues such as this holistically and I wanted to make that part of the full committee record that that was something that we did receive and discuss at length at the subcommittee.

I don't know if you guys have anything you want to add to what I just said.

MR. KITCHEN: Mr. Ray, Bob Kitchen. No, I don't have anything else to add. I think you've summarized it very well.

MEMBER RAY: Okay. Then if there's not anything more for Duke and Westinghouse, we'll turn the table over to the staff for their presentation. And they've got an extra ten minutes, it looks like.

(Comments off the record.)

MEMBER RAY: John, you can proceed when you're ready.

MR. MCKIRGAN: Thank you.

(Pause.)

MR. MCKIRGAN: So, good morning, members of the Committee. Thank you very much for this opportunity to present. I'm John McKirgan. I'm chief of Licensing Branch IV. I'm actually filling in for Don Habib, our lead PM on this, who has done an outstanding job of shepherding the staff through this process. He was called away unexpectedly, but the staff will demonstrate our agility and move forward.

With me today are Tim Drzewiecki, Boyce

Travis and Michelle Hart. They will be presenting the first few items. And then we will swap out for some other reviewers to fill in the next items and we'll move forward.

If I could just back up for a moment, as Mr. Ray just mentioned, there have been a number of subcommittee meetings on these topics and others. The last full committee meeting on this application was actually back in 2011.

So, the staff and the subcommittees and certainly the applicants have been very busy in that time. So, this is just a brief overview of some of the other subcommittee meetings and some of the other issues that we've addressed.

What we're going to talk about today, of course, are these major issues. There were six departures, I think we've got that clear now, and we will walk through these five issues and six departures.

The condensate return system of course had two separate departures, MCR dose, habitability, combustible gas control and the IEEE-603 flux doubling.

With that, moving smartly, again, I'll just go through our presenters. Boyce Travis and Tim

Drzewiecki will talk about condensate return. Michelle Hart will speak to the control room dose. Boyce will come back again to talk about the control room heat-up.

At that point, we'll swap out reviewers and we'll bring in Anne-Marie Grady and Robert Roche to talk about the hydrogen ITAAC. And Jack Zhao will talk about the flux doubling logic.

With that, I will move quickly on and we'll turn it over to Tim and Boyce to walk us through the condensate return review.

MR. TRAVIS: And so, to briefly summarize the licensing impact associated with condensate return, this is the exemption that includes two departures. One departure summarizes the design changes associated with condensate return, which include the addition of gutter system, the gutter system on the polar crane girder and stiffener and the -- basically the guttering and routing changes made to the containment shell.

And then the second departure is associated with the language change from "indefinite" to "14 days" and some other associated language changes with that in Chapter 6 and 7.

As you can see, there are a number of

different chapters affected by this change, tech specs 6, 15, 19 and the design changes in chapter 3.

So, the staff's findings with regard to containment impact for the condensate return change, this design change and associated analyses changes don't have any impact on the containment peak pressure analyses. Because for the purposes of maximizing pressure, the peak pressure analysis had some assumptions that are -- would not apply in the case of condensate return -- or minimizing condensate return.

There is no effects on the ability of the spargers, which are associated with ADS 1/2/3, to perform their function even in a reduced PRHR level, because the spargers are located about midway in the IRWST.

The containment flood-up level in the case -- in case you go to open loop cooling following the actuation of the PRHR HX after some period of time, the containment flood-up level is unchallenged. Even though the analysis made by Westinghouse increases the holdup volumes in containment slightly, there's sufficient head in containment to maintain open loop recirculation cooling.

And the calculated -- staff found the calculated condensate return rate in the long-term, which is about 80 percent, based on testing and analysis acceptable.

When I refer to testing, staff is only basing their conclusions on what Westinghouse calls "Phase 1 testing." Staff was not made aware of any of the Phase 2 results. And those Phase 1 testing -- the conservative assumptions used include, as the applicant alluded to, a loss of a hundred percent above the 12-degree weld line, which is containment rainout, a hundred percent losses over beams that have a 90-degree attachment to the shell, and a variable loss rate over attachment plates that don't have a beam associated with them and that range is from about 30 to 70 percent depending on the temperature and the flow rate over the attachment plate.

I'll turn it over to Tim to discuss the findings -- staff findings associated with the passive core cooling system.

MR. DRZEWIECKI: Staff reviewed the impacts on the passive core cooling system by looking at the decay heat removal and safety injection functions of that system.

Staff was able to find that Chapter 15 analyses were not impacted, but there was an update to section 6.3 of the FSAR which would identify Chapter

15 non-LOCA event and extend that out to 72 hours. That analysis showed that Chapter 15 acceptance criteria remained satisfied for a period exceeding 72 hours.

Additionally, staff found that the condensate return rate was sufficient for the PRHR heat exchanger to meet its design requirement of cooling the RCS to below 420 degrees in 36 hours.

Additionally, staff found that the ability to transition to open loop cooling is retained as a backup through passive RHR.

Additional considerations that occurred during this review is the impact of the ambient heat losses during a design basis accident, as well as ADS equipment qualification.

Sensitivity studies have demonstrated that heat losses in the RCS, and from the pressurizer in particular, could result in a decrease in pressure to the point that subcooled margin is lost.

The applicant evaluated the timing and the impact of the loss of sub-cooling through a combination of analysis and experimental data. That evaluation demonstrated that a loss of sub-cooling would occur at a time that exceeds 72 hours.

Additionally, that evaluation demonstrated that with passive RHR, will continue to function when the RCS pressure is reduced to saturation pressure.

Staff was able to make findings that there was no impact on Chapter 15 DBA analysis. Additionally, there was no impact on the safe shutdown analysis.

There was an update to the ADS actuation criteria. Staff found that that criteria established a diverse and reliable indication of reactor core cooling.

Similarly, staff was provided with information on the ADS equipment qualification such that they made reasonable assurance finding that open loop cooling can be established during an extended station blackout event.

MR. TRAVIS: And so to conclude, the staff findings associated with condensate return change -- the staff findings that were made in September 2014 with regards to the analysis changes were not impacted as a result of the methodology changes that Westinghouse discussed earlier. Which include that the Chapter 15 analyses remain bounding and were not impacting by the design change, and that the passive core cooling system is still capable of cooling the RCS to 420 degrees in 36 hours.

The addition of the consideration of ambient heat losses does not adversely affect the Chapter 15 analyses especially in the first 72 hours where ambient heat losses actually assist the system to perform its function.

A loss of sub-cooling is expected to occur within the first 14 days, but that would not degrade the performance of the PRHR to perform its function. And that's based on analysis and test data from the applicant.

And ultimately the transition to open loop cooling via ADS is retained as a backup to the PRHR and, thus, the staff finds the system acceptable.

MR. MCKIRGAN: So, I believe that completes the staff's presentation on this topic.

MEMBER STETKAR: John, let me ask you this. We had a little -- some discussion during the subcommittee meeting on it that the introduction to Section 21 of the SER, the statement is made that the staff evaluated each of the departures for impact on the probabilistic risk assessment. None of them have any impact on the quantification of core damage frequency or large release frequency.

And the end of that paragraph concludes that the staff finds that the cumulative risk impact of these design changes and departures is negligible. We had some discussions about that.

Is the staff planning to change that paragraph in the SER?

MR. MCKIRGAN: So, if I could, first, let me ask Mr. Malcolm Patterson from the staff to speak to the substance of that.

MR. PATTERSON: I am Malcolm Patterson. I am in the Severe Accident and PRA Branch.

No, we do not plan to change that language. The staff continues to maintain that the change in risk due to these actual changes and the revision to the design is negligibly small.

It's important to make these changes. These changes are being made not because of the risk significance, but because they are necessary to either comply with regulation or to meet design objectives that the applicant committed to.

MEMBER STETKAR: The design certification PRA assumed that 90 percent of the water was returned to the IRWST. That was a fundamental assumption. That was the basis for the long-term operation of the passive RHR heat exchanger.

So, does anyone know if the design certification PRA had accurately evaluated the actual return to the IRWST for the certified design, what the design certification PRA risk value would have been?

MR. PATTERSON: It's difficult to make that assessment, because these are not commensurable factors in risk.

The mission time of the PRA is 24 hours. And the IRWST would not be empty within 24 hours even if the losses were much larger.

So, you're talking about a change in risk that's not being quantified and trying to assess its impact on the risk that has been quantified.

MEMBER STETKAR: I don't want to pursue this any further, because I -- it's -- to me, it's just -- I just don't -- I get too emotional about it. I'll just let the record stand on what was stated on the record.

MR. PATTERSON: Thank you.

MEMBER RAY: Anything else on condensate return?

(No response.)

MR. MCKIRGAN: So, with that, we'll move on to main control room dose and Michelle Hart will lead us through this topic.

MS. HART: So, back in July of 2014 Westinghouse did come in with a presentation saying that there were some discrepancies with the main control room dose. The main one that I found interesting was that it did not include the direct dose from the VES filter.

They have described the changes -- or the discrepancies this morning, earlier today. They included they needed to do some rework on the direct radiation contribution to the main control room for sources other than the VES filter, and also the main steamline break did not include the most limiting release scenario for the control room. It did include the most limiting release for the offsite doses.

The design changes include an exemption request and site-specific departure. And it revised all of the design basis dose analyses, it added a VES filter shielding and a related ITAAC for that filter shielding. It reduced the tech spec allowable secondary iodine coolant -- iodine activity concentration to account for the increase in the main steamline break mass release.

It revised radiation monitor setpoints so that the -- it would ensure that GDC-19 is met for all of the DBAs with some margin. And also changed the VES actuation signal name from "high-high" to "High-2."

The changes to the DBA dose analyses included the direct dose from the VES filter including that in the total dose amount, changes in the shielding analysis methods used by the applicant, and there were additional analysis changes made to either increase the analysis margin to account for the additional dose that was from the VES filter to update methods or incorporate updated detailed design information.

Some of these changes also affected the offsite dose. So, there are revisions to all of the design basis dose analyses and all of the results -- or most of the results for the control room doses, and offsite doses as well.

The majority of the doses did go down because of these changes. However, the rod ejection accident dose did go up because they changed a method that's a newer method that increased the amount of damage to the fuel that was assumed. It is an acceptable method. So, they just adopted a newer acceptable method.

The review methods that the staff used is we did some scoping calculations to compare to what they said the changes were. We audited their design packages. We audited their dose analysis packages for the design basis accidents. And we also audited specific MCNP shielding input and output files to look at the -- both for the VES filter, a direct dose and for the streaming through penetrations and through the walls.

The staff did find the proposed changes are acceptable because they either used methods that were previously found as acceptable for the DCD, or they used methods that are in conformance with our guidance.

The other changes that were updated, detailed design information such as control room volume or control room ventilation flow rates, were just appropriately reflected or they reflect proposed site-specific changes to the design as noted in the departure.

The margin in the calculated main control room dose ensures compliance with GDC-19 for the use of the safety-related VES system. And the revised DBA dose analyses remain below the applicable dose criteria for estimated offsite doses.

CHAIRMAN BLEY: I want to interrupt and go back. I had to let this sift through my head for a minute, this risk discussion.

We heard one justification at the

subcommittee meeting that didn't seem to make a lot of sense to me. We heard one today that says, well, the PRA only goes for 24 hours.

Well, a PRA is pretty well established, usually does a 24-hour time period. But if there are events beyond that that are important, it ought to look out at those.

Regardless of all that, the statement in question doesn't say the PRA this or the PRA that. It says we find that there's negligible change in risk and we heard that you don't know what the change in risk was. It just seems -- I agree with John on this one a lot. Softer language that says what you do know would make a lot more sense than something that so far nothing rationale seems to hold together.

MEMBER STETKAR: I think we could probably state that it does not increase risk.

CHAIRMAN BLEY: Very easily.

MEMBER STETKAR: But we don't know the delta from what was quantified -- well, what perhaps should have been quantified in the design certification PRA. We just don't know that.

MR. MCKIRGAN: Thank you. Anything --

MEMBER POWERS: And I'm sure we know that unfiltered in leakage is a problem for these control rooms typically not at the design stage, not at the construction stage, but 20 years down the line.

Did you look at any of that?

MS. HART: The control room dose analyses do account for unfiltered in leakage both through the ingress and egress during this -- during the operation of the VES, and also through leakage through the walls. So, there's -- they do have a main control room testing program included in the technical specifications. So, they're going to surveil that.

MEMBER POWERS: So, they'll keep it so that the unfiltered in leakages could not slowly become a problem.

MS. HART: It is -- I'm sorry?

MEMBER POWERS: Does not become a problem over time.

MS. HART: It is not supposed to become a problem over time. It is a performance-based testing scheme, but, yes, there is a tech spec program for that.

MEMBER POWERS: What is the unfiltered --

MS. HART: I have it noted somewhere.

(Laughter.)

MS. HART: I do. I have to, right?

MEMBER POWERS: It's not a crucial number for me to have.

MS. HART: I do not have that. I believe it is around the order of 10 CFM.

MEMBER POWERS: That would be --

MS. HART: It's a very low leakage control room because it's a bottled air system with, you know, isolation from the outside environment.

MEMBER POWERS: Yeah. Very well.

MR. MCKIRGAN: With that, I'll -- we'll take just a moment to swap out some staff and we'll bring up Anne-Marie Grady and Robert Roche and Jack Zhao to walk us through -- I'm sorry, my apologies. My apologies. We have one more, Boyce Travis on the control room heat-up. So, sorry guys.

MR. TRAVIS: Unless someone else wants to come up and give my presentation.

MR. MCKIRGAN: Boyce, please walk us through the --

MR. TRAVIS: So, yeah, I'll speak briefly about the staff's review associated with the load shed in the main control room heat-up analysis.

So, from the staff's perspective, there are two periods of interest for acceptable control room conditions. The first 72 hours where VES is in operation, the new heat loads which are reflected in the DCD are reflected in the revised GOTHIC analysis which goes from a one-node control room to roughly 200-node control room.

For that first 72 hours, the equipment qualification dry-bulb temperature, I think, is the limiting value and it has to remain below 95 degrees. And the main control room remain substantially lower than a wet-bulb globe temperature of 90 degrees during the first 72 hours.

Following that in the period between three and seven days, they bring in ancillary fans to blow outside air through the control room.

The applicant assumed a diurnal temperature curve with a peak of 101 degrees and a 15-degree delta between day and night, and a constant wet-bulb temperature of 82.4 degrees.

The staff performed an analysis of the temperatures in Tampa near the Levy site, which is the AHOT site near the Levy plant, found that those values were bounding.

Staff also looked at other AP1000 sites and found that the worst case wet-bulb globe temperature over -- so, the worst average wet-bulb globe temperature over four days and the worst single hour wet-bulb globe temperature were both bounded by the applicant's assumptions.

And so, staff concluded that there was reasonable assurance that the main control room would remain below wet-bulb globe temperature of 90 degrees for seven days even under the worst case outdoor conditions, and it would be substantially lower under the expected conditions.

So, the human performance impacts associated with the design change are associated with the Stage 2 load shed of the Wide Panel Information System.

As the applicant indicated, the Stage 1 load shed doesn't remove anything crucial to operation of the plant. The Stage 2 load shed removes the Wide Panel Information System.

In order to have an event that results in the removal of the Wide Panel Information System, you need a VES actuation with offsite power available. these all involve multiple independent failures and/or beyond design basis event.

And even if this event does happen, the inventory of controls required to operate the plant is still available and no indication is lost by the operators as a result of the load shed.

MEMBER STETKAR: Boyce, you said it's

multiple independent failures that are beyond design basis event.

The VBS system is a non-safety-related system. So, I'm not sure why that's a beyond design basis event that I would lose normal main control room ventilation from a non-safety-related system.

MR. TRAVIS: So, ultimately with regards to this, we're talking about this in respect to an event that would require them to continue to operate the plant in the period where the VBS was failed, VES actuated and they were continuing -- so, this human performance analysis is with regards to them continuing to operate the plant.

That's not an expected condition. By tech specs, they would have to shut the plant down within 26 hours. And ultimately they would have the available indication -- there would be no impact to the indications provided by the --

MEMBER STETKAR: Boyce, I'm not arguing with what they have or what they might have. I'm arguing with the statement that you made on the record that said that this -- getting into the situation of loss of normal control room ventilation is a beyond design basis condition.

It is not beyond the design basis of the licensing of the plant, because the normal main control room ventilation system is a non-safety-related normal system. Therefore, I'm not sure how loss of it is a design basis accident.

MR. TRAVIS: I'll defer to Paul. This is all in regards to --

MEMBER STETKAR: I understand about how long -- what the tech specs say how long they can operate without normal main control room ventilation and things like that.

MR. PIERINGER: Paul Pieringer working in the Human Performance and Operating Licensing Branch, NRC.

The words I chose there, "and/or," I was trying to distinguish between some events that were just a loss of redundant trains, and others that were actually a design basis event.

I -- the scenario that we're talking about here would be a loss of a non-safety-related ventilation system. And I had categorized that as a loss of redundant trains.

Now, one of those trains could have been lost because of maintenance, but I just characterized that as that train was unavailable.

It would have required a second loss

during that maintenance duration that characterizes --

MEMBER STETKAR: And I'm not arguing with that, Paul. I just want to make sure that for the record we're not talking about this -- the condition that's been evaluated here, the limiting condition of loss of normal ventilation with AC power available, I just want to make sure that we're real clear that that is not a beyond design basis event. It is -- that particular condition is simply loss of a non-safety-related ventilation system.

MR. TRAVIS: That, we do agree with and the event has been evaluated as a design basis event with regards to main control room heat-up.

I think this was in response to the scenarios that were evaluated that would put us in this condition that would require operators to continue to operate the plant without shutting it down.

MEMBER STETKAR: Okay. I think we've got enough of that on the record. I just wanted to make sure it was clear. Thanks.

MR. TRAVIS: Sure. Do you have another question or --

MEMBER STETKAR: Yeah, I don't know if you'll -- yeah, you're talking about human performance. Let me get back to the heat-up analyses --

MR. TRAVIS: Sure.

MEMBER STETKAR: -- because as I mentioned when I asked Westinghouse earlier about what loads were included in their revised analysis, I went back in the last day or so and reread the SER.

And the SER specifically says under the load shed non-1E MCR heat loads are de-energized by automatic actuations of the protection safety monitoring system within three hours after VES is actuated, and the 24-hour battery heat loads are terminated or exhausted at 24 hours to maintain the assumed heat load values which then maintain the occupied zone of the MCR and the zones containing qualified safety-related equipment within the temperature constraints at 72 hours following VES actuation. That's a long sentence.

At the end of that paragraph it says, these conditions are reflected in the GOTHIC model which was audited by the staff.

That, to me, seems to say that the staff thought that the 24-hour battery loads were lost at 24 hours --

MR. TRAVIS: So --

MEMBER STETKAR: -- which is a different complement of things.

MR. TRAVIS: -- there are two analyses that applicant conducted. One was basically concurrent with the station blackout.

MEMBER STETKAR: Yes.

MR. TRAVIS: And one was with the -- effectively with AC power still available.

MEMBER STETKAR: Right.

MR. TRAVIS: In both scenarios there are loads that are shed at 24 hours. There are less loads shed in the 24-hour scenario at -- with offsite power available. And so, that analysis has a higher heat load.

But as you'll see in the applicant's analysis, there is a load shed at 24 hours and a concurrent reduction the heat losses --

MEMBER STETKAR: There is.

MR. TRAVIS: In accordance with the DCD, the table -- at 24 hours, they have a reduced loading at 24 -- at that period.

MEMBER STETKAR: I didn't see the -- the problem is I only had Revision 19 of the DCD --

MR. TRAVIS: Okay.

MEMBER STETKAR: -- which was done under

the old station blackout stuff which takes credit for the 24-hour loads --

MR. TRAVIS: Right.

MEMBER STETKAR: -- all of them going away.

MR. TRAVIS: In this case, some of the 24-hour loads do still go away. And that is reflected in both the DCD and the applicant's GOTHIC analysis.

MEMBER STETKAR: Okay. Has Westinghouse agreed to that? Because I thought that I was told that the 24-hour loads remained available for your analysis.

MR. TRAVIS: If you have access to the slides, I can point you to one of Westinghouse's slides and one of our slides that do show that, but -- or the applicant, if they'd like to speak to this?

MEMBER RAY: Maybe we --

MEMBER STETKAR: Keep going to other topics.

MEMBER RAY: Yeah, they're conferring and we'll put something on the record then, John.

MEMBER STETKAR: Thanks.

MR. TRAVIS: So, in conclusion with regards to main control room heat-up, it remains within the temperature and the limits for EQ for both the first 72 hours where VES is in operation, and the period between three and seven days.

Additionally, the staff found that change in acceptance criteria from the effective temperature that's in the DCD to wet-bulb globe temperature of less than 90 acceptable, because the wet-bulb globe temperature is associated with an unlimited stay time and endorsed by NUREG-0700.

And finally, the staff found that given the low probability of events and the available indications to the operators, the load shed does not impact human performance.

MEMBER RAY: Let me ask Westinghouse if they need some more time to -- yes, they'd like some more time. So, just don't let me forget, John. So, go ahead.

MR. MCKIRGAN: So, if we could, now is the time to swap out for our reviewers. Thank you, Boyce. And now we'll bring in Jack Zhao, Anne-Marie Grady and Robert Roche.

(Pause.)

MR. MCKIRGAN: So, our next topic that we'd like -- our next topic that we'd like to present is the combustible gas control in containment, the hydrogen vent ITAAC. And Anne-Marie Grady will begin our presentation on that material.

MR. GRADY: Good morning. The issue here is ultimately containment integrity. We're evaluating a departure that wants to change the Tier 1 ITAAC for a distance from a hydrogen vent in the containment to the containment shell. And the specific wording -- although the reference is there, the specific wording is not, but the distances are what are being changed. And the purpose of the ITAAC is to confirm this distance.

There are several ITAACs for several different rooms in the containment, and all except this room meet the existing ITAAC. This one is being revised.

The goal here is to keep any postulated hydrogen diffusion flame sources away from the containment pressure boundary to prevent conditions leading to potential failure of the shell or the hatches or the penetrations.

A burning hydrogen plume from the passive core cooling system PXS-A compartment room to the core makeup tank room, could potentially challenge containment allowable limits.

This is a single, low probability, as has already been mentioned, event involving multiple failures.

The applicant in evaluating the ITAAC, the existing ITAAC for this room, realized that there was a configuration change in this room and that the analysis had to be redone for this room only.

They performed a CFD, a computational fluid dynamics, sensitivity analysis to see where on the containment shell or the hatch were the hot spots. See how the plumes, the hydrogen plumes behaved.

After identifying where they behaved, and I can go into the physical configuration if no questions on that, but after identifying where the -- how the hydrogen plume behaved, they performed a one-dimensional heat transfer analysis modeling radiation and convection to calculate temperature distributions on the containment pressure boundary in the area near the lower equipment hatch.

The maximum temperatures on the containment shell on the equipment hatch which projects into the containment about five feet, and the hatch barrel, were calculated and then averaged for input into the program which is used for the structural analysis.

And this is a table which is in the SER, but there's another table in the SER, but this has the hot spot temperatures on the second column. It has the average temperature, that is the surface temperature averaged through the material, and those temperatures are for the containment shell, 442 degrees; on the plate, 308; on the hatch cover, 577. And when only radiation was considered, they're slightly less.

Those are values that are required. Those temperature distributions are required for the input into the structural analysis.

MR. ROCHE-RIVERA: So, yes. This is my slide here. So, good morning, members of the Committee. My name is Robert Roche. I'm a structural engineer with the Office of New Reactor.

I would like to also make a note that I'm presenting this information in place of Pravin Patel. Pravin presented this information during the subcommittee on Tuesday, but cannot be with us today.

So, I would like to indicate that as discussed during the subcommittee meeting, the structural analysis for the containment integrity evaluation performed by the applicant are prompted by the elevated temperature associated with this hydrogen event.

The staff audit the applicant's structural analysis and found that this analysis demonstrate that the metal resultant stresses remain well below the ASME Service Level C allowable stresses as indicated in the slide.

And, therefore, in conclusion, the staff concluded that the applicant analysis has met the ASME Service Level C requirements. And, therefore, the containment integrity is not challenged by this event.

MS. GRADY: Staff concludes that the methodology and assumptions in the analysis for determining the temperature source terms from the hydrogen burns are appropriately conservative and the results are acceptable to be used as input into the structural analysis.

And based on the staff's evaluation of containment survivability, we find that containment integrity is not challenged due to the diffusion flame hydrogen burn from the CMT-A room in the containment.

MR. MCKIRGAN: I believe that finishes the staff's presentation on that topic.

CHAIRMAN BLEY: No other questions. We'll ask you to move on then.

MR. MCKIRGAN: Very good. We'll turn to Jack Zhao, who will walk us through the IEEE-603 flux doubling logic.

MR. ZHAO: Good morning. Next slide. Clause 6.6 in IEEE-603, operating bypass, requires a safety system to prevent activation of operating bypass for safety systems if permissive conditions are not met or initiate a safety function.

So, the applicant find in the current design for this safety logic, it does not meet as a criteria in Clause 6.6 in IEEE-603, operating bypasses. There was no permissive condition implemented in the PMS system.

So, in order to meet the regulatory requirements on operating bypasses, the applicant proposed to add a new permissive condition called P-8 and also made a few other changes to their logics.

Next slide. So, staff reviewed the new permissive condition and the changes to the logics, and found the proposed changes acceptable and meet the criteria in Clause 6.6, operating bypasses. And that concludes my presentation.

MR. MCKIRGAN: So, that concludes the staff's presentation on that topic. I believe Westinghouse might be prepared to speak to the 24-hour --

MEMBER RAY: Okay, John, do we -- we need Boyce and Andy to come both to the table, or do you want to -- think we can handle it here? All right. Thank you, staff members.

Okay, John. I'll ask you to refrain what it is you're looking for so we don't wander around here too much.

MEMBER STETKAR: Okay. Question to Westinghouse. Does the revised main control room heat-up analysis with loss of normal ventilation and AC power available, account for active shedding or loss due to other conditions of any of the loads from the 24-hour batteries at 24 hours, if that's precise enough?

MR. PFISTER: That is precise enough, and I think Boyce and I were answering slightly different questions for that.

MEMBER STETKAR: Okay.

MR. PFISTER: I believe I understand what you're looking for. In the heat-up analysis, there is an assumed load shed at 24 hours.

MEMBER STETKAR: At 24 hours.

MR. PFISTER: That load shed is of non-safety-related equipment located in the control room.

MEMBER STETKAR: Okay.

MR. PFISTER: That is primarily EDS-powered equipment. And the only thing that is automatically load shed is some 24-hour lighting.

MEMBER STETKAR: And that's even -- that's -- I hate to interrupt. I just want to make sure I understand.

That's even with all AC power available?

MR. PFISTER: That's even with all AC power available.

MEMBER STETKAR: Okay.

MR. PFISTER: So, the loads that I'm talking about, though, that are shed are primarily not on the safety-related 24-hour batteries.

So, we have non-safety-related EDS batteries that are assumed to be load shed at 24 hours.

MEMBER STETKAR: Okay. Now, let me make sure. Because as I said the other day, I'm really simple and I'm really precise.

MR. PFISTER: Yes.

MEMBER STETKAR: I know we have four 24-hour safety-related batteries, right -- well, are they considered -- I have to be careful.

Are they considered safety-related batteries?

MR. PFISTER: We have four divisions of safety-related batteries.

MEMBER STETKAR: That are rated for 24 hours.

MR. PFISTER: At least 24. Two stations are rated for 72.

MEMBER STETKAR: They're not the two 72-hour batteries.

MR. PFISTER: Correct.

MEMBER STETKAR: Okay. So, we're talking -- right now I'm talking about those four safety-related batteries.

MR. PFISTER: Yes.

MEMBER STETKAR: Is anything removed from them at 24 hours for your heat-up analysis?

MR. PFISTER: The only thing removed from them at 24 hours is control room lighting.

MEMBER STETKAR: Okay. And that is --

MR. PFISTER: So, the other loads that are shed at 24 hours are assumed to be terminated, are things like laptops in the control room.

In our analysis we account for ten additional laptops in the control room. At 24 hours, those loads are assumed to be exhausted.

MEMBER STETKAR: Why are they assumed to be exhausted if AC power is available, though? I understand the analysis for -- the previous analysis for the station blackout whether it happens precisely at 24 or some later time.

MR. PFISTER: All of the non-safety-related receptacles in the control room are de-energized as part of that initial load shed. I think there was a comment about a rogue vacuum.

MEMBER STETKAR: Yes.

MR. PFISTER: And so, there's no power outlets in the control room to power anything.

MEMBER STETKAR: That's -- but that's the --

MR. PFISTER: So, these laptops are assumed if you or I brought our laptop into the control room during this loss event and continued to rum them for the first 24 hours.

MEMBER STETKAR: Okay.

MR. PFISTER: And so, it's those type of heat loads that are assumed to be lost at 24 hours.

MEMBER STETKAR: But is that as a result -- again, maybe I'm being too simpleminded. As I understand it, there are now two active load sheds. One, some stuff gets de-energized actively at time, I'll call it, zero when VES is actuated; is that correct?

MR. PFISTER: That is correct.

MEMBER STETKAR: And is that these -- the outlets?

MR. PFISTER: These outlets are a load shed, yes.

MEMBER STETKAR: Okay. Good. And then some other complement of stuff gets shed at three hours after T zero; is that correct?

MR. PFISTER: That is correct.

MEMBER STETKAR: Okay. Does anything else get actively shed at 24 hours, or are you simply saying that my computer dies at 24 hours?

MR. PFISTER: The only other item that's actively shed at 24 hours is a certain amount of control room lighting.

MEMBER STETKAR: Okay. And that happens regardless of whether --

MR. PFISTER: Correct.

MEMBER STETKAR: Regardless of whether AC power is available or not.

MR. PFISTER: Yes.

MEMBER STETKAR: And the analysis does account for that.

MR. PFISTER: Correct.

MEMBER STETKAR: Good.

MR. PFISTER: At 24 hours in the analysis, there are other loads that are assumed to be terminated.

MEMBER STETKAR: Yeah, like my laptop or whatever.

MR. PFISTER: Yes.

MEMBER STETKAR: Got it. I think I understand that.

MR. PFISTER: Sorry for the --

MEMBER STETKAR: No, no, that's -- it's fine. When I read the SER, the SER just says "the" 24-hour battery loads are terminated or exhausted at 24 hours, which is a verbatim statement from the previous loss of all AC analysis. It was extracted precisely from that previous analysis when, indeed, you assume that all of the 24-hour battery loads go away.

And that's what -- that's what hung me up. I get it. I understand. Thank you.

MR. PFISTER: Okay.

MEMBER RAY: Okay. Thank you, John.

MEMBER STETKAR: Sorry.

MEMBER RAY: This John here, is there anything more that you have?

MR. MCKIRGAN: That concludes the staff's presentation.

MEMBER RAY: Okay. Well, while you're still there, John, and you're by yourself, I know, but I just want to underscore again something I said earlier. But in the case of the staff presentation of the subcommittee, it did include presentation on vendor inspection history, which referred us to non -- Notice of Nonconformance. I'm trying to get it right. I'm used to notices of violation, but Notice of Nonconformance; one having to do with organization, and one having to do with corrective action that pertained to an inspection conducted at Westinghouse. And more information was provided to us at the subcommittee concerning those matters.

Okay. That being said, there -- on the agenda now, Mr. Chairman, there is an opportunity for public comment and I assume you'd like me to proceed with that. Okay.

And I'll ask that the bridge line be opened. It's not been popping and cracking. So, I assume it's not been.

And while that takes place, I'll ask if there's anyone here in the audience with us who would like to step to the microphone and make any comments. You're welcome to do so at this time.

(Pause.)

MEMBER RAY: I see Mr. Wen returning, and I'll trust that that means that the public line, telephone line is now open. And I'll ask if there's anyone on the telephone line who would affirm that they can indeed speak to us. If so, please simply say who you are, and then I'll ask if there are any comments.

Well, perhaps if anyone would like to acknowledge the bridge line is open to us, it would be helpful.

(No response.)

MEMBER RAY: Hearing nothing, Mr. Chairman, I must assume there's no one on the bridge line and, therefore -- ah, there -- please.

CHAIRMAN BLEY: If you'd like to make a comment, please state your name and make your comment.

(No response.)

CHAIRMAN BLEY: Thank you.

MEMBER RAY: I think we've done our due diligence with regard to the bridge line. We are 15 minutes ahead of time, which I'm sure the committee welcomes. I want to acknowledge the responsiveness and thoroughness of the applicant and the staff and what they're brought to us here. And we will in the course of this full committee meeting, decide if we can produce a letter. And if so, what its content will be, but that's for later in the discussion.

With that, I'll turn it back to you.

CHAIRMAN BLEY: Thank you, Mr. Ray.

At this time we will recess until 10:45 when we'll take up Reg Guide 1.229.

(Whereupon, the proceedings went off the record at 10:10 a.m. for a brief recess and went back on the record at 10:45 a.m.)

CHAIRMAN BLEY: The meeting will please come back to order.

Before we go on to the next real topic, I have an announcement for the members. There was a training session you all heard about that looked like an hour and a half at 12:30. It will be at 12:30. It won't last that long, but the people will be here for an hour and a half if you need additional help from them on training efforts.

At this point, I would like to turn the meeting over to Professor Ballinger to lead us through the Reg Guide 1.229 discussion.

MEMBER BALLINGER: Thank you Mr. Chairman.

Today we have members of the NRC staff and NEI actually to brief the Subcommittee on their development and finalization of Reg Guide 1.229, which is the Risk-Informed Approach for Addressing the Effects of Debris on Post-Accident Long-Term Cooling.

During our March 26th, 2016 and November 3rd, 2015 meeting, we received briefings on the subject as it related to the proposed 10 CFR 50.46(c) rulemaking. The staff has incorporated comments from the public, the nuclear industry, and NRC offices and is getting ready to finalize and issue the regulatory guide.

Today we have Stephen Geier I think -- maybe not.

PARTICIPANT: Yeah, he's here.

MEMBER BALLINGER: He is? And Wayne Harrison, who is -- from STP -- who is here via phone, I hope, representing --

MR. HARRISON: I am here.

MEMBER BALLINGER: -- good -- representing industry views on the subject of the regulatory guide.

Now I'll invite Russel Felts, he is here, Acting Director, NRR Division of Risk Assessment, to introduce the presenters and start the briefing.

MR. FELTS: Thank you, sir.

We appreciate the opportunity to discuss Reg Guide 1.229 with ACRS today. Reg Guide 1.229 addresses an important safety issue, specifically, GSI-191, that has proven very difficult to resolve. The reg guide incorporates lessons from the South Texas Project pilot application. It benefitted from significant input from many internal and external stakeholders, and the reg guide is ready to go.

We expect at least 10 licensee submittals using a risk-informed approach, starting this year. We therefore believe that it is in the best interest of the NRC and the industry to publish the guidance sooner rather than later.

NRC plans to add additional less conservative approaches as soon as technical bases are developed, but the approach in the reg guide will be beneficial to many licensees as is.

The NRC staff is requesting an ACRS letter today recommending issuance of Reg Guide 1.229. This would support publication of the reg guide along with the final 50.46 rule consistent with the Commission's policy on the cumulative effects of regulation.

With that, I turn it over to CJ Fong for the staff's presentation.

MR. FONG: Thanks, Russ.

Some quick introductions: my name is CJ Fong. I am the Team Leader for Risk-Informed Licensing in NRR. To my right is Steve Lauer, who is the Senior Risk Analyst, also in NRR, and Stephen Smith who is the Senior Reactor Engineer in NRR Division of Safety Systems.

As Russ said, we're here to talk about Reg Guide 1.229, which is Risk-Informed Approach for Addressing GSI-191, or, if you prefer, using the risk-informed provision in 50.46(c).

A couple key messages today for the ACRS: first, we're requesting a letter, and I'm going to provide kind of two reasons why we feel that a letter is appropriate.

First is the Commission policy on cumulative effects of regulation, or CER. Second, I'm going to talk a little bit about the licensee schedules that have been shared with the staff. And then too I'm going to talk about some of the technical issues that have been discussed in the previous Subcommittee meetings and other public forums and share with you why we conclude that the reg guide is ready for use now.

So first, and this was back on March 22nd, the Subcommittee asked us to specifically address why we want to publish the reg guide now. I think in fact the question is what's the rush?

And so one of the key things driving us is the Commission policy on the cumulative effects of regulation, which states pretty clearly that draft guidance should come out with draft rules or proposed rules, and final guidance should come out with final rules. So as the final 50.46(c) rule is now with the Commission, we feel it is appropriate to move forward with this reg guide, which provides implementation guidance on the risk-informed portion of 50.46(c).

MEMBER REMPE: Well, if you're going to do that, though, I also thought this really applied to GSI-191, and what happens if the rule were not approved by the Commission? Doesn't this draft guide still provide guidance that is useful to industry?

MR. FONG: It does, and in fact, we talked with our reg guide expert just a few days ago, and the reg guide itself would be published with 50.46(c). If 50.46(c) doesn't -- the Commission decides not to approve it, or if it's delayed, we still feel that having this guidance in place, albeit in draft form, with, you know, "preliminary" stamped on it, still provides a path for licensees to respond to Generic Letter 2004-02.

So there are -- in fact, it's a good segue here. The so-called Option 2 plants are the licensees that have told the staff they intend to use a risk-informed approach to address GSI-191, and that was the whole Option 2 classification from SECY-12-0093, so there's about 10 or so licensees that want to use that method.

If they -- if 50.46(c) is available, then that's a clear path for them to do that without exemptions, which is what the staff was directed to do by the Commission. If 50.46(c) is not available, the technical approach would look very similar and this guidance would be very useful. They would probably need to come in for an exemption to some of the GDC or portions of the existing 46, but as far as the technical analysis, the methods that would be used, it would look very similar, and this guidance would be helpful for both the licensees and the staff.

VICE CHAIRMAN CORRADINI: So -- so let me make sure, because I think I was the one on the phone asking this question.

I am still struggling with the, well, I'll call it streamlined, quasi-conservative portion of the reg guide. I think it's Appendix B.

MR. FONG: C.

VICE CHAIRMAN CORRADINI: And the -- and the -- and I'll use the word incomplete -- maybe that's not the right word, you guys pick the right word -- the incomplete Appendix C guidance on the LOCA.

MR. FONG: Okay, yes.

VICE CHAIRMAN CORRADINI: And so in this form, granted it's out, but is it -- is it -- and I'm going to ask the NEI representative when he shows -- is industry really going to use this version, or are they going to wait for I'll call it an updated version relative to at least Appendix C, and potentially a more complete thinking of Appendix B?

Because to me, it strikes me that this is -- well, I guess that's -- I'll just stop there. I'll leave it at that question.

MR. FONG: Yeah --

VICE CHAIRMAN CORRADINI: Is it your impression that there are licensees that are going to use what you put out?

MR. FONG: Yeah, I prefer to let NEI speak for themselves as far as what they want to do with Appendix C, just that one piece, which is LOCA frequency allocation.

I'd point out that there's a lot of other useful guidance in the reg guide that we do expect licensees to use, things like the zone of influence, transport trees, coatings, there's a lot of other things in the guidance that we feel are not controversial, ready-to-go. We would expect industry to use those.

As far as what they want to do with that one piece, the LOCA frequency allocation, I'll let them --

VICE CHAIRMAN CORRADINI: Okay.

MR. FONG: -- tell you about that.

VICE CHAIRMAN CORRADINI: So I'll characterize it, and again, I'm being somewhat provocative so you can see where I'm coming from: I view the streamlined Appendix C approach with the Appendix B approach, with the current Appendix C as almost like an -- equipped with an Appendix K version of peak clad temperature, where everything but the LOCA frequencies is pretty much conservatively bounded, so I'm not exactly sure what I'm getting from it.

MR. LAUER: Well --

VICE CHAIRMAN CORRADINI: That is my interpretation of what I read, so --

MR. LAUER: Let me answer that if I can. What you're getting from it is -- first of all, Appendix B came from actual experience with the pilot application where they switched from a very detailed approach to the simplified approach, and Appendix C is a hybrid of that and something we heard at a meeting with a different licensee.

So yes, there are several licensees that could use this as is, the Appendix B method with the Appendix C LOCA allocation approach. And we don't know if they all --

VICE CHAIRMAN CORRADINI: Okay.

MR. LAUER: -- could succeed that way, but certainly our confirmatory calculations that we've done indicate that it would be acceptable --

VICE CHAIRMAN CORRADINI: Okay.

MR. LAUER: -- although very conservative.

VICE CHAIRMAN CORRADINI: All right. I had a couple other points, but I will wait. Thank you.

MR. FONG: So as Steve pointed out, and was said in the opening remarks, the staff is currently developing some more realistic LOCA frequency allocation methods that will eventually live in Appendix C.

And we talked about this a little bit back in March, but we have a team put together, formed with representative from NRR and Research. They are working on those methods. They have a plan in place that has been approved by management, and they have a target to complete that update late this year, early next year.

And just to point out that the focus right now is on providing some additional flexibility and realism in Appendix C, but of course with any reg guide, we're going to be cognizant of OE as it comes in, and so as we learn lessons from the pilot plant, from the first couple subsequent non-pilot plants, we can certainly incorporate that information into a Revision 1, and that would include, you know, feedback from any stakeholder, really.

The goal right now of the active improvements are of course centered around Appendix C, but we're going to take a holistic look at anything we learn, and again, we can certainly update the reg guide as necessary based on that experience.

So the final slide here talks about the path forward. As Mr. Felts said, we believe the reg guide is ready for use right now. We have achieved internal NRC concurrence, and no legal objection from OGC.

You will hear a bit more from the industry, but our understanding is they agree that the reg guide is ready to go and should be published.

The bounding method in Appendix C right now is probably a little on the conservative side, but we think it is suitable for this, what we've seen at least for the early plants. And again, we will certainly, as with any reg guide or any document really, we'll be aware of OE and operating experience, and we'll incorporate that in the future revisions as necessary.

MEMBER STETKAR: We -- since that is the end of the staff's presentation, we have a little time available for discussion.

CHAIRMAN BLEY: All the topics you would like. Please go ahead.

MEMBER STETKAR: So during the --

MR. HARRISON: South Texas can comment on that if you'd like.

MEMBER BALLINGER: Say again?

MR. HARRISON: I said -- this is Wayne Harrison from South Texas Project, and I could give you some feedback from our perspective if you'd like.

MEMBER BALLINGER: Fine, good. Go ahead.

MR. HARRISON: I -- thank you.

I'll just start out by saying that we agree that the draft reg guide should be issued with the -- with the real change package, that it -- that, you know, like the introductory remarks that were made commented, that it was -- it's consistent with the goal of issuing guidance along with the rules.

And I think from the standpoint of what CJ said, it does provide the definition of the content needed for the risk-informed application. So if you're coming in, a licensee is coming in with a risk-informed application, following the regulatory guidance answers a lot of questions with respect to what needs to be in that application, what needs to be in the application for a simplified approach, what needs to be in the application for a more -- more detailed approach.

And the -- the regulatory guidance has some flexibility incorporated into it, which is probably both -- good points and bad points associated with it, but I would say for the complexity associated with the variations in the -- in the plants, with their debris characteristics and their design differences, I think the ability to have flexibility is an advantage to the licensees in the application of the reg guide, and as CJ commented, it will probably also result in maybe future changes to the reg guide.

But again, the point is that the regulatory guidance, it's got the right areas of focus for the licensee making the submittal and having the dialogue with the staff.

From the standpoint of the South Texas Project application and what we have in the content of our pilot application for the risk-informed approach to GSI-191, which started as a detailed approach and then transitioned to a simplified approach, we believe that what is in that guidance is consistent with -- with what we have used in our process and has been -- led to successful dialogue with the staff.

So that's pretty much the summary of our comments in -- on the basis of agreeing that the regulatory guide is -- is ready to be -- to be issued and for use.

CHAIRMAN BLEY: Thank you. This -- yeah. I'd like to follow that up with a question for you from South Texas.

In doing the simplified approach, you had the advantage I guess I'd say of having done the detailed, and having an awful lot of information in place to do a really thorough job on the -- the simplified approach.

I am wondering if you've looked closely at the guidance on the simplified approach and think if that's where you were starting, would that guidance, would it have been reasonable for you to discern how much of that information that you've used from the detailed work you did, you'd need to do to support the simplified approach?

MR. HARRISON: I haven't done that specifically from that perspective, but I would tell you that my -- my gut reaction is the answer is that it does, and the reason I say that is when we went from the detailed approach to the simplified approach, a lot of what we had done in the detailed approach was not as useful for the simplified approach. We had a lot of correlation information that -- that we did not need, and it was no longer applicable.

But a large part of what we still use from the detailed approach might be the -- the modeling and the -- the ability to determine the amount of debris generated and transported from specific locations.

CHAIRMAN BLEY: So --

MR. HARRISON: But --

CHAIRMAN BLEY: Go ahead.

PARTICIPANT: We lost him.

VICE CHAIRMAN CORRADINI: So are you still on a line? Is the South Texas --

MR. HARRISON: I am still here.

VICE CHAIRMAN CORRADINI: Okay.

MR. HARRISON: I am --

VICE CHAIRMAN CORRADINI: So let me -- since you brought it up, let me ask: is it my -- am I mischaracterizing it that except for the LOCA frequency and the location of determining where the break is and the size of the break and therefore the debris generated, the rest of Appendix B looks to me to be a deterministic calculation based on experimental evidence?

MR. HARRISON: That is an accurate characterization. What the Appendix B does is that you have a deterministic element that's based on the tested amount of debris, and you have a risk-informed element that's based on the likelihood of breaks that can generate more fine-fiber debris than what was -- than what was tested.

VICE CHAIRMAN CORRADINI: Okay. All right. Thank you.

CHAIRMAN BLEY: Thank you.

MR. HARRISON: Sure.

CHAIRMAN BLEY: John? We are ready.

MEMBER STETKAR: I kind of wanted to explore three topics that we discussed at some length during the Subcommittee meeting.

And one of them -- the first one pertains to what we heard about what needs to be included in the application. If I look at the guidance, especially -- well, if I look at the guidance, first of all, in Appendix A, and this also applies to Appendix B, so whether I do a detailed analysis or whether I do a simplified analysis, there's a statement that says "As a minimum, any scenario or group of scenarios meeting any of the following four inclusion criteria should be included in the risk-informed analysis," and I'll just paraphrase: scenario response involves recirculation; it involves a potential for debris; a mechanism that can transport debris to the sump; and the debris is sufficient to result in core damage.

So that is good. I -- I get that. The -- the discussion in the reg guide, the guidance says, well, I can do some sort of screening analysis to eliminate scenarios, but I have to include LOCAs, and I can't do any screening of LOCAs, I have to include all LOCAs, regardless of the size or location.

And the rest of the guidance emphasizes almost completely LOCA analysis. Now there -- there can be plants, and I don't know because this is regulatory guidance written for anyone who wants to apply it, there can be plants for which certain types of transient scenarios may generate debris. I don't know.

Transient scenarios, for example, that involve initiation of feed and bleed cooling, where I blow down through the pressurizer relief tank and could transport debris from that location. There can be scenarios that involve main steam line and feedwater line breaks at various locations that can also transition to feed and bleed cooling, which would have additional possibility of debris from those steam line breaks.

There can be seismic scenarios that don't fail any piping, but could generate debris from non-seismically-qualified stuff -- I don't know what that stuff is -- but then could also transition to feed and bleed cooling because I don't have any main feedwater available, for example.

I don't see in the guidance the type of emphasis that I would hope to be there, and this is my own hope, to point people to think about that broad scope for their plant and justify the basis for why those types of scenarios are screened out, because it just tells me I can do screening on things that are not LOCAs.

That is all it tells me. It does not

really tell me what I can do, you know? It says I -- I -- if they are not important, or -- I've forgotten the words, I don't want to search for them right now.

So one of my concerns is if this guidance is being issued for anybody out there, and the staff expects in the interest of clear guidance to minimize subsequent large numbers of plant-specific RAIs, that for your particular plant, might be a two-loop plant, might be configured much different than South Texas, might have much different kinds of insulation, for your particular plant, please provide me the answer of why did you screen out these following 300 scenarios?

Wouldn't it be better to have in the guidance a little bit more clarity about the staff's expectation for people to look at sources of debris and transport scenarios in addition to the LOCAs, which -- which is by far the predominant guidance?

MR. LAUER: If I could take a crack at that one, maybe we were naive by putting in the screening criteria and putting up front that all sources of risk, all operating modes and hazards, need to be considered that lead to recirculation, et cetera.

But it -- all four examples you gave have been addressed by the South Texas. Three were addressed immediately in this initial submittal, and one is the result of an RAI, okay?

And the -- the -- I guess if after we issue this reg guide we find people coming in and continually not addressing those other scenarios, then I guess we'd have to clarify, but I --

CHAIRMAN BLEY: Steve?

MR. LAUER: Yes sir.

CHAIRMAN BLEY: The thing bothers me about that, I think that's great, but I am thinking a few years from now, when maybe you guys aren't the ones who are reviewing what comes in, and maybe the people who have not done all the background work that South Texas did are applying, maybe some of that will get missed if it's not in the guidance.

MR. SMITH: Maybe what we should do is when we do the change, this is one of the items that we should flag to, you know, to emphasize that, you know, you can't just look at LOCAs. Get that -- make that more clear in the guidance.

I think it is in there that you have to look at those other things, but I agree it is probably not emphasized as much as LOCAs.

MEMBER STETKAR: I think Dennis's point is, and we've talked about this a little bit, that wipe your mind clear of the South Texas experience. South Texas did not occur because you -- the staff is coming -- Steve has mentioned, well, yeah, we had to ask some RAIs of South Texas, and they finally looked at those other kinds of scenarios.

Wipe that clear. South Texas didn't exist. This is guidance that I as Plant X am going to pick up and use to -- to submit a risk-informed exemption for a license amendment, whatever it's called.

And think in that context. And think in the context of what is the bare minimum that I need to do to satisfy the staff. And this very quickly to me in that mindset funnels me into I need to look at LOCAs, and I can get rid of anything else. Yeah, it says, okay, I have to think about other things, but I can screen that stuff out pretty easily.

Now, put yourself in the shoes of, as Dennis said, a couple years from now, a different reviewer who then focuses on oh, yeah, in Section A-1, there's these four requirements, and -- and this particular applicant didn't address 300 different scenarios that I can think about, you know, please here's 300 RAIs, why didn't you address this one? Why didn't you address this one? Please provide justification. Please provide quantitative justification.

It can just devolve into something that gets really messy, and I think that you could clarify the expectations right now going in to just remind people of the scope of things that they need to think about, and justify why they screened out something, and why LOCAs are only important for their plant, or why LOCAs at a particular steam line break location is important for their plant.

MR. LAUER: I think Steve had a good comment.

I mean, that is excellent feedback. I think that would be a great thing to -- to think about for Rev 1.

But I think it is very clear, even if you're just coming in cold, that we stated everything. Maybe it could have been clearer had we written it in a hierarchical manner and put all the LOCA stuff in an appendix so that you went right through, because we clearly state that you have to -- to consider all these things and screen them, and further, this -- this builds on the existing Reg Guide 1.174, Reg Guide 1.200, and the standard that says the same type of thing.

So we -- the reason LOCAs predominate the guidance is because that's where the problem is. We usually look at seismic because Steve --

MEMBER STETKAR: At the plant that you looked at --

MR. LAUER: Oh no no, I don't mean the problem in terms of risk from debris. What I mean is it -- a seismic event looks at seismic at the whole plant.

A main steam line event -- this is an application where location-specific initiations are important for LOCAs, and therefore, you can slice and dice the frequency, and we want to be careful that people don't treat this in such a way that the scenarios screen out to determine cases.

MEMBER STETKAR: Steve --

MR. LAUER: Maybe I am not communicating --

MEMBER STETKAR: It makes a lot of sense for the things that you've thought about, which is LOCAs. It might be that a location-specific steam line break of a certain size with a certain jet could be important for my plant that you haven't looked at yet. It could be.

MR. LAUER: That's true, yes.

MEMBER STETKAR: It could be that a location in my containment where I store a bunch of anti-C clothing in a cabinet that is not seismically qualified that could fall over in a particular -- below acceleration to cause piping failure event could distribute the anti-C clothing because you have not thought about that, and that might exist in my plant.

So there can be these location-specific issues is my whole point that -- that require a different amount of attention, or perhaps a different focus, than -- than the LOCA things that you've thought about so carefully, because I don't know. I don't know for my plant.

MR. FONG: Yeah, I --

MEMBER STETKAR: I mean I know my plant, but if I am focused -- if I am very quickly told to only look at LOCAs and the staff is only expecting me to very carefully look at LOCAs, maybe we're all going to miss something.

MR. FONG: I don't know if I'd quite go that far. I mean, we say, as Steve pointed out, we -- the guidance specifically says you can't just look at LOCAs, and when we talk about location-specific initiators, we're careful to say if a LOCA event or other scenario where the effects of debris may be location-dependent, so I will certainly -- I agree we can be a little more specific and improve that, but I don't think it's accurate to say we hadn't thought about that or that we didn't think about other -- other scenarios that might have a location-specific component.

CHAIRMAN BLEY: My point of view, you guys rated what's in there as embedded, and you see your intent as well. When somebody knew --

MR. FONG: Sure.

CHAIRMAN BLEY: -- looks at it, they see it differently, and my impression was, yeah, the LOCA is everywhere. It just -- it feels as you read it, you get it over and over again.

And you're right, you do cover this stuff. It's just when you get -- especially when you get more operational in the back, LOCA LOCA LOCA is what you're --

MR. FONG: Sure.

CHAIRMAN BLEY: -- not just Appendix C, Appendix B.

MR. FONG: I understand, it's hard to proofread your own --

CHAIRMAN BLEY: Yeah.

MR. FONG: -- writing sometimes. I

understand what you're saying.

MR. LAUER: Well, and it's good feedback, and I think -- I don't know -- my opinion is it shouldn't hold up Rev. 0, and hopefully before the next generation comes along that's going to forget all that stuff, we'll improve it in Rev. 1, so I think that's something we can commit to.

VICE CHAIRMAN CORRADINI: I'm sure you have a number -- you have more, right?

MR. LAUER: At least two more, yeah.

VICE CHAIRMAN CORRADINI: Sorry, I'm sorry.

MEMBER STETKAR: I have two more, and we have 45 minutes, and NEI needs some time, so --

VICE CHAIRMAN CORRADINI: We have NEI.

MEMBER STETKAR: They need time for their presentation.

We can come back to this, obviously, if we have time left.

Now the second one is that, if I look at Reg Guide 1.174, there -- part of the guidance in there says that I have to account for uncertainties in my risk-informed decision-making.

And it is clear, the guidance very -- very clearly tells me that when I look at LOCA frequencies, I have to have an uncertainty distribution for the LOCA frequency. That is pretty clear. And the implication is that I use the mean value from that distribution for any of my let's say point estimate calculations.

There's essentially no other mention of uncertainties in the guidance except it says, in Section C-4 under uncertainty, it says "In addition, portions of the analysis using NRC-staff-accepted deterministic methods do not require quantification of uncertainty (model or parametric). The NRC considers the accepted deterministic methods to be conservative enough to compensate for uncertainty.

NRC recognizes that some methods that were accepted in the past are currently not considered to contain significant conservatism. However, the most recent methods, for example, those accepted in Regulatory Guide 1.82, are considered to be adequately conservative."

So I went back because I had not read 1.82 in a while, and I reread it, and it doesn't really address uncertainty either. It just says well, select something in this area that's bounding or sufficiently bounding or adequately conservative or those types of words. It doesn't say anything about uncertainty. It says the uncertainties are broad, but pick for your deterministic analysis something that is adequately conservative.

I am paraphrasing there. I have several other quotes, but they get boring.

So I also went back to NUREG-1855 that's cited in this reg guide, and I looked at the section in NUREG-1855 that talks about modeling uncertainty and the use of so-called consensus models, and in there, it specifically says "The use of a consensus model eliminates the need to explore an alternative hypothesis, but adoption of a consensus model does not mean that the consensus model has no uncertainty associated with its use.

However, this uncertainty would generally be manifested as an uncertainty or the parameter value or values used to generate the probability of the basic events to which the consensus model is applied. This uncertainty would be treated in the PRA quantification as a parameter uncertainty. The adoption of a consensus model obviates the need to consider other models as alternatives."

So okay, if I use the modeling approach in Reg Guide 1.82, I don't need to account explicitly for model uncertainty, but I somehow do need to account for uncertainty in those parameters, for example, the amount of debris generated, transport analyses, deposition analyses, cumulative effects of chemical and particulate and fiber effects.

And I see nothing in the guidance that tells me I need to consider that. In fact, I am told that I don't need to consider it. In fact, I am told that the staff doesn't expect me to consider it at all.

And I would think that that is contrary to the fundamental guidance in Reg Guide 1.174, and furthermore, an explicit assessment of uncertainties, and by that I don't mean a quantitative assessment, I mean a -- at a minimum, a qualitative assessment of uncertainty, can be awfully, awfully useful to decision makers when they start to examine an application and determine how much margin is available in whatever quantitative estimates have been provided in that application.

We have heard from the industry that the elements of the simplified analysis are excessively conservative. Well, if I had at least some sense of the amount of uncertainty, even a qualitative assessment, I might have a better appreciation of how conservative they actually are: you know, am I actually using an absolute bounding value for which something cannot be worse?

So I -- I am left really empty by this notion that the guidance does not tell me at all to use any type of evaluation of uncertainty, except for those LOCA frequencies, because everybody knows that LOCAs frequency is important.

I don't know if the staff has any response to that. That was a long --

MR. SMITH: Well --

MEMBER STETKAR: -- monologue.

MR. SMITH: As far as -- I can talk about, you know, how the deterministic parts have been treated. I can't talk about whether we should treat parametric uncertainty in this type of evaluation or not. I could talk about it, but these guys would be better at it.

But the uncertainties associated with the deterministic methods that we used to evaluate the debris issue have been attempted -- the uncertainties have been -- people have tried to quantify those uncertainties, and they have had a difficult time in order for -- in order to get the NRC to basically back off the -- some of the requirements we make on them because, as they've stated, they're excessively conservative, and it creates problems for them evaluating their plant.

Because we have not been able to quantify these uncertainties very well, we have not -- you know, that is why we've required these conservative evaluations, and we have -- we believe we have conservatisms in every step of the analysis, okay? So they -- the industry claims that these are compounded, and it makes everything much more difficult for them to show that their -- their plants can survive a -- a LOCA event or some of the LOCA events.

So that's the -- the bottom line is we've had trouble quantifying the uncertainties.

MEMBER STETKAR: Stephen -- and I was pretty careful I think, I have to go reread the transcript, but I was pretty careful to say that I wasn't necessarily advocating a quantitative evaluation of the uncertainties in each element of what is now characterized as a -- the deterministic part of the analyses.

A qualitative assessment of the uncertainties and an explanation of -- of those uncertainties for each of those elements I think would be very very useful. It -- we -- you know, I believe that this value that I'm using for whatever parameter it is is absolutely bounding and it could never be worse, for the following reasons. Or I believe that there's a small likelihood that it could be worse, but it's only a small likelihood for the following reasons.

Those are qualitative assessments. They're engineering assessments. They're not trying to quantify what that probability is.

MR. FONG: Well the guidance, Mr. Stetkar, does tell licensees to address uncertainty, and we provide a bulleted list of areas, for example, as you mentioned, initiating event frequency, but also debris generation transport, chemical effects, et cetera, so I think that was the idea, was that we wouldn't just ignore uncertainty, it would be a discussion of the key areas, and the answer might be, well, we feel like it's bounded because we're using a conservative staff-approved method, but certainly, we don't want to just ignore --

MEMBER STETKAR: You know CJ, I read that initially, and I was okay with that at a very high level, until I got to the paragraph that I cited verbatim, which explicitly tells me that as long as I have a deterministic analysis following the guidance in Reg Guide 1.82, I do not need to address uncertainty. It tells me that explicitly.

So if I am now somebody coming in, I am now told by the staff that I don't need to address uncertainties, regardless of the high-level stuff that's in the introduction, here is explicit guidance to me --

MR. LAUER: But what we were trying to do there is to say this is a consensus method, therefore it's not a key source of uncertainty, therefore you can ignore the model uncertainty, and you're pointing out that the parametric is not excluded from that. Okay.

MEMBER STETKAR: Parametric is not excluded by --

MR. LAUER: Right.

MEMBER STETKAR: That is correct.

MR. LAUER: Understand, so --

MEMBER STETKAR: And it -- and again, for the record, I will say it the third time, I am not advocating an explicit quantitative evaluation of uncertainty for each of those parameters, regardless --

MR. LAUER: Right.

MEMBER STETKAR: -- of what they are, in

that whole generation/transport/deposition part of the analysis, because those are really really difficult to do. It's not clear even people using the detailed method could get it right. South Texas tried, I think.

But at a minimum, a qualitative assessment that would both answer the higher-level I think they're bullets, I can't open the whole reg guide right here on the single screen, that -- to support a risk-informed assessment, and it would also provide the industry a means of demonstrating where they think the real sources of conservatism may lie in a particular analysis.

So if a particular -- a particular break location comes really really close to the margin one way or the other, there would be better support from their perspective about how conservative might that be?

MR. LAUER: I think Steve already talked about the -- we tried to build margin, or they tried to build margin, in the deterministic.

In the PRA models, when we do parameter uncertainty, maybe I'm wrong on this, but I don't believe we take every parameter, for example, success criteria. So you say this system can put out 1200

GPM. Realistically we only need 1,000 GPM.

MEMBER STETKAR: Right. But you can't --

MR. LAUER: We do not do a parametric uncertainty on that, and what we're looking at is this is a success criteria for the go/no go case where we hopefully have enough conservatism built into determining that number, and conservatism in assigning a conditional core damage probability of 1.0 if it's above the number.

I understand what you're saying, and I -- I hope it's in the Reg Guide 1.82 that talks about the conservatisms, right?

MEMBER STETKAR: It talks about conservatism several places. I reread the whole thing on the plane, and -- and it -- it uses terms like "adequately bounding," some places it just uses the term "bounding," some places it says things like "sufficiently conservative to account for the very large uncertainties."

It is -- it says things like that. It doesn't say "always use an absolutely bounding, cannot-get-worse-than-this amount" --

MR. LAUER: Okay.

MEMBER STETKAR: -- for, you know. It says things like "sufficiently conservative," which to me might -- to me might be, well, maybe there's only a five percent probability that it could be worse. To somebody else, it might say there's a, you know, a 49 percent probability that it could be worse because as long as it's 51 percent that it could be better, that's sufficiently conservative. Those are very -- they're not defined at all.

As far as success criteria, and again, it -- you can't -- it's true, success criteria, we don't try to evaluate the likelihood that I have 0.8 pump running, so, you know, I'll require one pump to be running, or -- or a 20 percent reduction in flow from a pump, what's the likelihood of that occurring? Many of the other parameter values we do propagate.

MR. LAUER: Definitely.

MEMBER STETKAR: So anyway, that's -- that's my long monologue on uncertainty.

Yes sir?

VICE CHAIRMAN CORRADINI: Can I ask a question just to clarify?

So in the reg guide, the simplified approach, maybe I'm missing it, I can't tell the difference once I determine where the LOCA is, or the break is, excuse me, and the zone of influence, how the deterministic calculation is that much different than 1.82. It looks essentially the same. Am I -- am I -- is that a fair characterization?

MEMBER STETKAR: It is the same.

VICE CHAIRMAN CORRADINI: Okay.

MEMBER STETKAR: It is the same. It points you to 1.82.

VICE CHAIRMAN CORRADINI: So then except for how I enter in how I wouldn't qualify for the deterministic calculation in 1.82, it is -- it's essentially a bounding calculation?

MR. SMITH: Yes.

VICE CHAIRMAN CORRADINI: Okay. So you're treating it -- well, let me just go one step further. So you're treating it essentially like an Appendix K calculation for the peak clad temperature?

MR. SMITH: Yes.

VICE CHAIRMAN CORRADINI: So turning back to John, if I were them, that's how I would have answered your point, which is --

MEMBER STETKAR: If indeed everything that they've used is bounding, but 1.82 uses terms like "adequately conservative to account for the broad uncertainties," "sufficiently conservative," and things. It doesn't say take a bounding value of the amount of debris or the flow rates or the configuration of the operating -- there are other subtle things like what pumps do you have running, what pumps do you not have running, given the configuration of your particular containment, that South Texas went through all those permutations.

They determined there can be some odd combinations of what's running and not running that might have a different impact on core damage versus containment failure, depending on, you know, how your spray systems work.

VICE CHAIRMAN CORRADINI: Right, but the reason -- the reason I am --

MEMBER STETKAR: Which is another source of uncertainty, that it -- Reg Guide 1.82 doesn't necessarily tell me to take the worst possible combination of flows.

VICE CHAIRMAN CORRADINI: Nor does Appendix A for peak clad temperature. It says use this correlation, use this, use this, use this. So what I guess, to get to my point, is, and I'm not sure where I stand on it, it's just that I view Appendix K as a cookbook for what is a bounding calculation for peak clad temperature, and I'd use this as a cookbook save for what the break is and what the zone of influence is in that Appendix C, as a cookbook calculation for blockage, either at the strainer or inside the core. Is that a fair characterization? Yes?

MR. SMITH: Yes.

VICE CHAIRMAN CORRADINI: Okay, fine.

MEMBER STETKAR: Except that remember, there aren't as many formula in 1.82. It says do sufficient testing to justify what values you've used, you know, and all it says is do sufficient -- and be careful that, depending on how you do the test, you might get different results.

The third item that I had, and this is kind of a somewhat more subtle and somewhat programmatic, if I use the simplified approach, it says use your base PRA to identify the scenarios that you're going to evaluate using the simplified approach. It doesn't tell me at all what I'm supposed to do with that, and as I just mentioned, for I know South Texas, depending on what particular combination of high-head pumps, low-head pumps, containment spray pumps I have running and the particular geometry of my containment floor and where the -- the debris is released, there might be some strange combinations of things that can lead to plugging that are not necessarily readily apparent.

Most PRAs just simply say one train running is good enough. And -- and if I am -- if I am only selecting maybe what might be the worst train running, I might get the wrong answer because most likely, I've got everything running.

The PRA doesn't care about that because that's more than it needs for that purposes, but it might be worse for my particular analysis in my particular plant, especially if I've only got two trains of stuff.

So it is not clear that the guidance, to me anyway, doesn't really emphasize that in the simplified approach. It does address it, it does address it when we talk about the detailed approach. However, the -- the section of the detailed approach where all of that good guidance is -- is given says I don't need to care about it at all for the simplified approach. It's one of -- I don't remember, it's one of the A dash --

MR. FONG: -- 3, yeah.

MEMBER STETKAR: A-3. And I don't need to care about that at all for the detailed -- for the simplified approach.

The last point is that for the simplified approach, once I get done with the simplified approach, I now have justification, hopefully I pass all the criteria, I now have justification, staff accepts it, I have a plant that has sources of debris in it, and I have justified based on a risk-informed argument that that plant is acceptable and it can continue to operate in that configuration.

I see nothing in the guidance that says I now need to update my PRA so that it accounts for the actual as-built as-operated plant, because my base PRA didn't account for all of that debris.

There is a requirement that says every four years I need to go back and recheck all of this stuff, but ought the PRA not account for the actual plant? Once you get done with this, I mean, this is a risk-informed application.

MR. FONG: Yeah, I think, well, this was discussed back in March also --

MEMBER STETKAR: Yeah.

MR. FONG: -- and I think the term that was used during the Subcommittee meeting was that this reg guide is quote "surgically focused," and I liked that term, actually.

And the goal here was to determine the portion of risk attributable to debris and assess whether that meets the risk acceptance guidelines strictly for the issue of addressing -- or strictly for the purpose of addressing 50.46(c) or the generic letter.

Where we are with PRA today is we're in an application-specific environment, and so we'll see different rules for PRA depending on whether you're talking about a significance determination process or a change to the licensing basis, and I think the rules to those have to govern how you use PRA in those particular situations.

MEMBER STETKAR: Well I guess we're going to get short on time here, so just for the record, I hope we're not trying to advocate, if I have six different applications, that I then have six different PRAs that are each specific to each of those applications, because that is not the sense of doing risk assessment.

MR. LAUER: No, but we are trying to do is not put a requirement in a reg guide that doesn't exist elsewhere. There's no requirement to update the PRA. If someone wants to come in for a certain application, certain applications like NFPA 805 require to reflect the as-built as-operated plant, and that would be a legitimate thing, but we're not putting that kind of requirement in a regulatory guide.

VICE CHAIRMAN CORRADINI: So just to clarify, since I knew John's three points, what you're really saying is that I have the base PRA, I use it as -- and modify it per these sorts of rules of the road, the cookbook, I now submit to staff, staff looks at it, approves of it, it passes on a risk-informed basis, and that's the end of it? It's a specialized case of using the PRA in a modified form, but it never -- it will never go back and re-baseline what the PRA is?

MR. FONG: That's where our reg guide stops I think --

MR. LAUER: Stops, yeah.

MR. FONG: That's not the end of the story. I mean, there are other reg guides and guidance out there, for example, Reg Guide 1.200, Reg Guide 1.174, that talk about what your PRA has to look like, what initiating events are there, how it models the as-built as-operated plant.

In licensing space, you've got to track cumulative changes, et cetera, but our reg guide stops at figuring out the portion of risk that should be attributable to debris.

VICE CHAIRMAN CORRADINI: So if the CDF

goes up or down in the base PRA, we'd never reflect it. It's only in the application here, in the specialized application?

MR. LAUER: When you say if it goes up or down --

VICE CHAIRMAN CORRADINI: In other words, I do some -- I follow Appendix B with Appendix C guidance, and I compute that the chance of the core damage from this event has decreased or increased as part of the risk-informed, that's the end of it. It's a specialized case. It doesn't reflect back on the base PRA?

MR. LAUER: Well, except --

MEMBER STETKAR: Just for the record, it won't go down.

VICE CHAIRMAN CORRADINI: I know.

MEMBER STETKAR: Okay.

VICE CHAIRMAN CORRADINI: But I am just saying generally.

MEMBER STETKAR: I think that, you know, I don't get it. I don't understand why the staff is reluctant to put that in there, but they are, so -- .

CHAIRMAN BLEY: Dr. Ballinger, you may need to move this forward.

MEMBER BALLINGER: Yes. I just keep

looking at the clock. I keep looking at the clock.

Are you all set?

(No audible response.)

MEMBER BALLINGER: Then thank you. I think we need to have NEI folks, I think. Yeah.

MR. GEIER: Okay, good morning. I am Steve Geier from NEI, and I just have a few brief comments to make, and then I'll turn it over to Wayne Harrison to see if he has any additional comments based on what he already talked about.

I do appreciate the opportunity to address the ACRS on this reg guide.

So basically, from our perspective is that this guidance is very important to provide the guidance needed to provide for additional flexibility in using the risk-informed approach to address the effects of debris post-accident.

The goal of course from our perspective is to ensure that this reg guide does assist the plants, and particularly PWRs, in addressing their open issues that are affecting them.

We also looked at it from a BWR perspective, and BWRs really are not included in -- in the reg guide at this point, and I know CJ and Steve have been in discussion with the PWR side, and if there's additional guidance that's needed down the road, we can ensure that that gets -- gets added.

And basically, as already has been talked about, the reg guide is really set up to address the plants. In particular, STP is the pilot project to assist them with resolving the GSI-191.

And with that, I'm going to turn it over to Wayne. Wayne, if you have any additional comments to -- to address from the pilot plant perspective?

(No audible response.)

MEMBER BALLINGER: We haven't heard --

MR. GEIER: Wayne, you on the phone?

MEMBER BALLINGER: Not much crackling and popping, so I'm wondering whether it's still -- I think he's on a separate line.

CHAIRMAN BLEY: We'll try to get it open. Just a minute now.

(Pause.)

MEMBER BALLINGER: He was here before.

PARTICIPANT: The line is open, even if Wayne is not on it yet.

CHAIRMAN BLEY: Okay, thank you.

MR. GEIER: Well I did communicate with him, you know, during this meeting and after his statements, and he felt that he -- he had gone over the comments that he intended to make --

CHAIRMAN BLEY: Okay.

MR. GEIER: -- and basically, he is supportive, and STP is supportive of issuing this reg guide. They feel it's important to assist them with moving forward with their submittal and resolving the GSI-191 as the pilot project.

MEMBER BALLINGER: Wayne, are you out there?

(No audible response.)

CHAIRMAN BLEY: There was a question earlier, Stephen, we were wondering if you know of other plants that are likely to use this in the near term, within the next six months or a year?

MR. GEIER: Yeah. This year, there's intended to be several other plants are lined up behind STP. STP is the pilot project, and they're taking the lead, and I believe the number is in the seven, seven range --

CHAIRMAN BLEY: Oh, okay.

MR. GEIER: -- that are going to be picking up, and after STP gets their application through, then the other plants will be coming in soon right after that.

MR. BLOSSOM: This is Steve Blossom from

South Texas. There's 13 other units that are following us, representing seven additional companies.

MR. GEIER: That's the seven.

CHAIRMAN BLEY: That's the seven, okay.

MEMBER BALLINGER: So I think that's -- you're done?

MR. GEIER: Yeah, anything additional, Steve, that you want to bring up?

MR. BLOSSOM: Which Steve? There's a lot of Steves.

MR. GEIER: Steve Blossom, sorry.

(Laughter.)

MR. GEIER: Steve, I don't know if you were on the line when Wayne did provide just an overview of his bullets, and just wonder from STP's perspective, Steve Blossom, do you have any additional comments or input?

MR. BLOSSOM: No, I don't. I can hear Wayne, but you can't hear Wayne, so I am not sure.

MR. GEIER: Gosh.

(Laughter.)

MR. BLOSSOM: To answer your question, I don't think Wayne had any additional comments, and neither do I.

MR. GEIER: Thank you.

MEMBER BALLINGER: I guess I'm confused now. I think the bridge line is open, I think. Is there anybody --

MR. HARRISON: This is Wayne. Can you hear me now?

PARTICIPANT: Yes.

MEMBER BALLINGER: Good. Do you have anything further to add?

MR. HARRISON: Nope.

(Laughter.)

MR. HARRISON: Just wanted to make sure you had the technology.

(Laughter.)

MEMBER BALLINGER: Okay. Is there anybody out on the bridge line that would like to make an additional comment? Might as well do that first, I guess.

(No audible response.)

MEMBER BALLINGER: I think it's open. Hearing none, are there any members of the audience here that would like to make a comment?

Sir, state your name and --

MR. GRISSOM: Yeah, I am sorry. Is this -- yeah, it's on.

Phil Grissom with Southern Nuclear, and we will be one of the next plants using this reg guide.

I just want to state that we've been working with the staff for a while and with South Texas and with the owners group, and all this is tied together, and I think -- think folks are really working to try to get it to resolution.

I have a couple of concerns, though, related to some of the questions that the ACRS had. I think it's rightly pointed out that this is basically, the way it's evolving, anyway, basically a deterministic calculation that uses LOCA frequencies to determine what sizes are important, and as such, it really, if you were to add this answer back into the PRA as part of your base model, I think there's a real likelihood it would overweight the importance of LOCAs because it's not -- in the end, it's not a best estimate consideration of debris effects of LOCAs or LOCA consequences the way it's headed now, certainly with the simplified approach.

Now that's acceptable for closing the issue, I believe, but if the real intent is to add this new intelligence back into a PRA, my belief is there's still some work to be done on how to make that happen without -- without really overemphasizing the importance of LOCA consequences.

That's it.

MEMBER BALLINGER: Thank you. Is there anybody else in the audience that would like to make a comment?

(No audible response.)

MEMBER BALLINGER: Hearing none, I turn it back over to the Chairman.

CHAIRMAN BLEY: Thank you, Professor Ballinger.

This marks the end of our morning session. For the Committee members, we have our own training session starting at 12:30. Please be back for that. And the next technical session of the Committee will begin at 2 o'clock. At this time, we'll recess until 2 o'clock.

(Whereupon, the meeting went off the record at 11:46 a.m. and resumed at 2:00 p.m.)

CHAIRMAN BLEY: The meeting will please come to order. And we'll proceed with another session led by Professor Ballinger. Ron, please go ahead.

MEMBER BALLINGER: Thank you, Mr. Chairman. It seems like only yesterday.

CHAIRMAN BLEY: Yes.

MEMBER BALLINGER: The purpose of this meeting is to receive a briefing on the framework for the storage and transportation of spent fuel. And particularly we will hear about ISG spent fuel retrievability as well as NUREG-1927, Revision 1, on renewal for dry cask storage systems. We'll also hear -- will we hear from EPRI or anybody? We'll hear from NEI, right? We'll hear from NEI on the subject matter mentioned. We have had several meetings in the past on NUREG-1927 and the ISG, March 24 is the most recent one. We will now proceed with the meeting. I'll call Mark --

MR. LOMBARD: Yes.

MEMBER BALLINGER: -- Lombard, Director of the Division of Spent Fuel Management, to give a brief introduction and introduce the presenters.

MR. LOMBARD: Very brief. Thank you, Dr. Ballinger. We appreciate the opportunity to come before the full Committee today. As you know, we presented the two subject documents to the ACRS Subcommittee for Metallurgy and Reactor Fuels just about a week and a half or so ago, maybe it's been two weeks now, has it been two weeks, maybe not so, and received valuable feedback on both documents, both products that we're working on.

ISG-2 Rev. 2 is the first document we're going to talk about today. It's a broadening and clarification of the definition of spent fuel retrievability, it revises the ISG-2 Rev. 1 and a definition which was written after the definition that we issued to the Commission back in 2001. We have made changes to it in response to the Subcommittee's comments and we really appreciate those comments and we have provided the revised document back to the ACRS and we trust that the changes resolved the Subcommittee's comments, but if you have further comments, I look forward to hearing those as well.

NUREG-1927, it's the first and a critical piece of the revised renewal framework for CoCs and ISFSIs that's been developed over the last two plus years only through extensive collaboration with NEI, industry, and other members of the public. We are very proud of the work that's been done on 1927 Rev. 1, and on ISG-2 Rev. 2, of course. The collaboration included our review of NEI Guidance 1403, which you heard about at our last meeting with the Subcommittee and you'll hear a little bit more about it today.

And our plan is, and I want to be clear about this, our plan is, because we agree with the concepts in 1403, we're looking at the details now, our plan is to endorse it at least in part and hopefully in whole in a future Regulatory Guide, which is our formal process for doing so. But I want to be clear that we do appreciate the collaboration, the collaborative process we have been implementing over the two plus years. The industry has really worked very hard with us on both the 1403 document and the 1927 document, and soon to be the MAAPs document, which will be out for public comment in the near future, and we're very happy with both guidance documents. And again, we're looking at the details of 1403 and hope to provide that endorsement in the near future.

NUREG-1927 Rev. 1 is critical for use by applicants and NRC reviewers as we build this new regulatory framework for renewals to be useful, not just for the NRC Staff, but also for applicants in coming up with a generic way to approach renewals in the future, and eventually with NUREG-1927 Rev. 1 and the MAAPs report, there will essentially be a pick list like system for people coming in for renewals, they'll be able to pick from and they'll be pre-reviewed by NRC Staff already and should speed up the renewal process significantly as we go forward. So, without further ado, we have several experts up here this afternoon. Emma Wong is going to talk to you about ISG-2 Rev. 2. Kris Banovac, in her normal spot, talking about 1927 Rev. 1, coming to be the near final draft. And then Kris Cummings will provide industry perspectives. So, take it away Emma.

MS. WONG: Sure. Thank you, Mark. So, as Mark already had mentioned, I'm going to be talking about the Interim Staff Guidance 2 Revision 2, which is on fuel retrievability and spent fuel storage applications. So, for this ISG-2, one of the applicable regulations is 10 CFR 72.122(l), which is on retrievability, and it's only applicable to general and specific license ISFSIs. Now, this regulation states that storage systems must be designed to allow ready retrieval of spent fuel, high level radioactive waste, and reactor related greater than Class III waste for further processing or disposal. Now, I'd like to emphasize here that retrievability really is the design to allow ready retrieval and that's kind of what the focus of the ISG is on.

Another applicable regulation is 10 CFR 72.236(m), which is applicable to Certificates of Compliance, so not the general or specific licensees, it's the Certificates of Compliance. And this regulation states, to the extent practicable in the design of storage casks, consideration should be given to the compatibility with removal of stored spent fuel from the reactor site, transportation, and ultimate disposition by the Department of Energy. So, what this really means is retrievability should be considered to the extent practicable when you're designing a Certificate of Compliance for a dry storage system.

So, first, a lot of our guidance has been in Interim Staff Guidances, specifically ISG-2, and these ISGs still exist because they have not been put into the SRPs fully yet. So, I'm basically going to just talk about the ISGs. So the first Guidance, which was issued in 1998, was ISG-2 Rev. 0. And in this Revision, it explained the origin of the rule and how it came into the regulations and that dual purpose of canisters were a means to meet retrievability, since it could be taken out of and off of the storage area and be put into a transportation cask without having to handle the individual fuel assemblies at all or the canned spent fuel.

Later, this was superseded by Revision 1 of ISG-2, which was issued in 2010. To meet retrievability in Revision 1, it states that you must have the ability to move the canister or a cask to a transportation package or location where the spent fuel can be removed and -- and the critical thing is "and" because both things have to be met -- and the ability to handle individual spent fuel assemblies by normal means. And this revision of the ISG reflected a time of a near-term repository and it was thought that the fuel would be stored for up to 40 years or one to two storage terms.

With the change in the paradigm to longer storage, which is kind of where we are now, there may be unintended consequences for needing to access the internals to confirm long-term performance for retrievability. Therefore, because we are moving to longer term storages, we thought it would be good to reevaluate the retrievability Guidance. And due to this, we have had a lot of public interaction to get stakeholder feedback, we've had lots of public meetings and we have solicited public comments twice.

As you can see here, it looks like from 2011 to 2013, we had a lot of interaction and then there's a gap until 2015. Well, that gap was for the storage license renewal to get their work to be accelerated. And once we were at a good place with that, we restarted the reevaluation of retrievability in 2015. Of course, a lot of this has already been heard at our ACRS Subcommittee meeting that we had on March 23, where we received a lot of good comments that were considered in the draft, and of course we're here today at the full Committee meeting. And all the comments that we got from the public, all the comments from the meetings and the Subcommittee meeting for ACRS, we have incorporated all of those into our ISG.

So, the Draft Revision 2, because it's not yet final, focuses on the safety and design basis to allow maximum flexibility to maintain safety for an undefined storage duration. Also, it is to continue to protect public health and safety and ensure that the spent fuel can be retrieved from its storage location safely for further processing and disposal. Of course, also in this Guidance we felt that we needed to provide additional guidance to our staff on how to look at retrievability and how licensees can meet retrievability in licensing reviews.

CHAIRMAN BLEY: Can I take you back a couple slides --

MS. WONG: Sure.

CHAIRMAN BLEY: -- to that requirement for being able to handle individual spent fuel assemblies by normal means?

MS. WONG: Yes.

CHAIRMAN BLEY: Does that imply there's some kind of a machine that's set up that can always open these things up and get inside?

MS. WONG: What that means is you should be able to pull out the individual fuel assembly from its basket or cell location just by a craning grapple. So, no cutting tools, no extraordinary measures. So, if it happens to get stuck and you can't just pull it out, you basically have not met retrievability.

CHAIRMAN BLEY: Okay.

MS. WONG: However, we have been in conversations with industry and they have methods that they have proven that they can get the fuel out by, I guess, not what we would consider normal means, but they have been proven means.

CHAIRMAN BLEY: Well, that's what I was hoping to hear, that that's more what it means. So --

MS. WONG: Well, the way that it was defined in this particular Guidance, it was just craning grapple, which --

CHAIRMAN BLEY: Okay.

MS. WONG: -- we felt was a little restrictive, since it has been proven that they can do it safely to do it by proven means and safe means. So that's one of the things that we wanted to change, to allow that, that that would not preclude you from meeting retrievability.

CHAIRMAN BLEY: So, I guess I'm a little confused. What does it mean, you wanted to change?

MS. WONG: So, we would allow, as long as you can perform that removal safely, and it doesn't need to be by normal means, as long as you can do it safely, then if you can remove the fuel, then you have met that part.

CHAIRMAN BLEY: Okay. And your intent would be that that's the kind of guidance that would be in the permanent Guidance as opposed to the --

MS. WONG: Correct. Right. So this is the current Revision 1, I'm going to get to what we are proposing and what we have -- well, it's out there in the public right now as a Draft Revision 2 --

CHAIRMAN BLEY: Revision 2, still to the ISG though? Okay.

MS. WONG: It's all for the ISG. But that is a very good question because it's one of the points that led us to reevaluating this Guidance. So, again, retrievability is based on the ability to perform ready retrieval, like we've just been talking about. And in Revision 2 of ISG-2, ready retrieval has been redefined. So, it's now the ability to safely remove the spent fuel from storage for further processing or disposal. And you have a few options now. And it's the ability to do one or a combination of the following, you can perform them in any sequence, in any combination that you need to.

Option A is to remove the individual or canned spent fuel assembly from wet or dry storage. Notice that the words normal means no longer appear and it's all about safety. Option B is to remove the canister loaded with spent fuel assemblies from a storage cask or overpack. And then Option C is to remove a cask loaded with spent fuel assemblies from a storage location. B and C, it really depends on whether you have a canister onsite or you have a cask onsite. Those are the only reasons that they're kind of distinct there.

I should note that all sites currently, all dry storage sites currently are using Options A and B or C. So they've all committed, like in Revision 1, to have a way to remove the individual spent fuel assemblies. Now it's not by normal means, it's by a safe means. And whether they have a cask or canister, you would choose B or C. For wet storage, there is one wet storage ISFSI that we do have, they would obviously choose option A because they do not have a cask or canister that will be moved around in their spent fuel pool. And the last option that can be chosen is you choose B or C, depending on if you have a cask or canister, and as long as you can safely remove it to start going to transportation or whatever action that you need to take next, that would also meet what we would define as ready retrieval for retrievability. Yes?

MEMBER RICCARDELLA: Help me with the terminology, do the casks in C have a canister inside them or not?

MS. WONG: They do not necessarily have a canister, but Bernie over here will be answering that question more fully.

MR. WHITE: Yes. I'm Bernie White, Senior Project Manager in the Division of Spent Fuel Management. So, in Option B, you have a dual-purpose canister that is located in an overpack, concrete overpack that's vented. Option C is designed where you have a cask, which may or may not have a canister, but it's a bolted lid cask, so it looks more like a transportation package if you will, thick wall, thick walled lid that you can just put impact limiters on and ship offsite. That's the differentiation between the two.

MS. WONG: All right.

MEMBER RICCARDELLA: Thank you.

MS. WONG: Great. All right. So those are basically a lot of the combinations you can choose. And basically, that's the end of my presentation about that, because that is the major change that was in ISG-2 Revision 2. If everything goes according to schedule, it should be issued final this summer. And I would like to, I guess, reiterate, we were not asking for a formal letter from the full Committee, but I leave it up to you whether or not you would like to write a letter. So, if you have any questions or additional comments for my consideration, that would be wonderful. It's really a short ISG.

MEMBER BALLINGER: The last meeting that we had, I thought I asked this specific question, do you want a letter, and I thought that I got an answer of yes. So now you're -- I was obviously wrong.

MR. LOMBARD: We want to be respectful to the Committee --

(Laughter.)

MS. WONG: We may have had some miscommunication there and that's okay. But if you would like to write a letter, I'm --

MEMBER BALLINGER: Okay.

MS. WONG: -- okay with that.

MEMBER BALLINGER: I just thought I'd be

clear on that because --

(Laughter.)

MS. WONG: If you've already spent time, we will be okay with a letter too.

MR. LOMBARD: I believe there was a discussion, after the formal presentation, that perhaps the Committee should write a letter on ISG-2. And we were in agreement with that.

MEMBER REMPE: Actually, I think when we were discussing it --

MEMBER BALLINGER: Okay. Now, I'm confused again.

MEMBER REMPE: -- we said it should be -- I think what we said at the end of the discussion was it ought to brought to the full Committee --

MEMBER BALLINGER: Right, yes.

MEMBER REMPE: -- to decide if --

MEMBER BALLINGER: That's exactly what I meant.

MEMBER REMPE: -- a letter is needed, is the way that the discussion ended.

MS. WONG: That's how I understood it. However, if there was some miscommunication, that's okay, we're here.

MEMBER BALLINGER: But what I thought I

heard was your preference, before the full Committee. That's what I thought I heard. Okay, that's fine.

CHAIRMAN BLEY: We have the preference now that they don't need one. But we can talk about that after this session is finished.

MEMBER BALLINGER: Yes, okay.

MS. WONG: If no one has any questions or comments, I will turn it over to Kris.

MS. BANOVAC: Thank you, Emma. Let me just cue up the next presentation. Okay. So my name is Kris Banovac and I'm a Project Manager in the Renewals and Materials Branch in the Division of Spent Fuel Management at the NRC. And I'm pleased to be here today to provide an overview of the proposed final NUREG-1927 Revision 1. And that is the Staff Standard Review Plan for Renewal of Specific Licenses and Certificates of Compliance for Dry Storage of Spent Nuclear Fuel. In my brief talk today, I'll briefly review the spent fuel storage renewal requirements and guidance, I'm going to provide some background on why we developed and what we considered in the development of Revision 1 to NUREG-1927, and then I'll highlight just a few of the changes that we made in Revision 1 of NUREG-1927.

I'd first like to review NRC's

requirements for renewal of specific licenses for Independent Spent Fuel Storage Installations, or ISFSIs, and Certificates of Compliance, or CoCs, for storage system designs. NRC regulations allow for renewal of ISFSIs and storage system designs for a period not to exceed 40 years, given that specific regulations that ensure that the storage systems continue to perform their intended functions as designed are met for the period of extended operation.

Renewal applications must include time limited aging analyses, or TLAAs, and those consider the effects of aging on structures, systems, and components, or SSCs, important to safety, and it assesses their capability to continue to perform their intended functions in the period of extended operation. Renewal applications must also include a description of the Aging Management Program and that would be for management of aging issues that could adversely affect the SSCs important to safety. In order for the NRC to approve storage renewals, licensees need to demonstrate that any aging effects on dry storage systems can be safely managed and addressed so that they do continue to perform their intended functions in the period of extended operation.

In February 2011, we updated 10 CFR 72 to include those specific requirements and also at that time, we issued the accompanying guidance for the Staff Safety Reviews of renewal applications and we published that in March 2011 and that's currently located in NUREG-1927 Revision 0. So, since the original issuance of NUREG-1927, the Staff has reviewed several renewal applications for both specific ISFSI licenses and also CoCs for storage system designs. And so, through those reviews, we had a chance to use and test the guidance in Revision 0 and we found that the guidance needed to be expanded and clarified in several areas. And we are also expecting to receive 15 renewal applications over the next several years.

And so, what we did is establish a storage renewal team that consisted of members throughout the NRC to look at our current storage renewal framework, as Mark had mentioned, to determine what changes were needed. We did identify a high priority need to update the guidance in NUREG-1927 and we also identified a need for development of other guidance, and we did talk about that in detail at the March 23 Subcommittee meeting.

For NUREG-1927 revision, we have had

extensive engagement with stakeholders throughout the process. We received valuable stakeholder input at many NRC sponsored meetings on renewal topics, including two public meetings that were focused specifically on the changes we were considering to NUREG-1927. We also coordinated with the ACRS Subcommittee on Metallurgy and Reactor Fuels. We originally met with the Subcommittee in April of last year, and that's when we came to talk about the Draft Revision 1, and then of course we met again a couple weeks ago to talk about the changes that we're putting forward in the proposed final Revision 1, after we consider the public comments that we received.

We did publish the Draft Revision 1 for public comment in July of last year and we considered all of the public comments that we received in preparation of the proposed final Guidance. And in addition, we also developed responses to all of the stakeholder comments that we received and we provided those also to the ARCS in preparation for the Subcommittee and this full Committee meeting. And we do plan to publish the final responses to the public comments when we do publish the final Revision 1.

This slide lists the structure and the format of Revision 1, which is for the most part consistent with Revision 0. In the Front Matter, it includes the abstract, abbreviations, and introduction. Chapter 1 is on the general information review. Chapter 2 is on the scoping evaluation, and that's the part of the renewal application that identifies the SSCs that are within the scope of renewal and, therefore, those are the SSCs that are reviewed further for the aging mechanisms and effects.

Chapter 3 of the Guidance is really the core of the Guidance. And it's on the aging management review, which is the process that's used to address the applicable aging mechanisms and effects that could adversely impact the SSCs that scope into the renewal and it proposes the appropriate aging management activities to address those aging effects. We added a list of consolidated references as a new Chapter 4. We also moved the definitions, which were in the Front Matter of Revision 0, to the new Chapter 5 glossary and we did make some updates and clarifications to several definitions.

And to discuss the appendices, we reviewed the five appendices that were in Revision 0 of NUREG-1927 and we did make some changes in Revision 1. We kept Appendix A, which was on non-quantifiable terms, but we actually deleted the other appendices as we found that those were not useful to the Staff's review process. In their place, we created some new appendices that we think provide useful guidance for the Staff and applicants. We developed three example Aging Management Programs related to spent fuel storage and we included those in Appendix B of Revision 1. Appendix C in Revision 1 is just currently reserved for future use.

And in Appendix D, we incorporated guidance from Interim Staff Guidance 24, which was issued in 2014, and that provides guidance on the use of a high burnup fuel surveillance program for monitoring fuel performance in the period of extended operation. In Appendix E, we included some information specific to CoC renewals, including information on the responsibilities of the CoC holders in the development of the AMPs and the TLAAs in the application, and then also the responsibilities of the general licensees in implementing the AMPs of the renewed CoC that they're using at their particular site. Finally, in Appendix F, we provided information on storage terms and the calculation of the length of the storage term of a dry storage system that's either loaded in the initial storage period of a CoC or during the period of extended operation of a CoC.

We did make updates and clarifications throughout NUREG-1927, I don't think there's a page that we didn't make a change on. And just in the interest of time, I'm going to just highlight some of the more substantive changes that we considered for Revision 1. So in Chapter 1, which is the general information review, we did expand the guidance on application content, and particularly we added some guidance for CoC renewal applications as we felt that was lack in Revision 0. We added a section on timely renewal and these timely renewal provisions exist in Part 72, where if the applicant has submitted a timely application, the license for the CoC does not expire until the NRC has made a final decision regarding the renewal.

We added guidance on how aging management should be considered in the case of concurrent amendment applications and renewal applications, and also amendment applications that are submitted for a license or CoC after we have renewed it. We also added guidance on terms, conditions, or specifications that may be added to specific licenses or CoCs as part of their renewal.

In Chapter 2, on the scoping evaluation, in Revision 1, we clarified sources of information and the specific content that can support the scoping evaluation. We expanded guidance for review of SSC subcomponents and scoping of fuel assemblies, and also identifying SSCs that are within the scope of renewal. And we clarified that the guidance on scoping of SSCs really depends on whether an SSC is considered part of the design basis for that particular license or that CoC. And in this chapter, we also clarified guidance for ensuring that any SSCs that were excluded from the scope of renewal, that there was a proper justification for that in the renewal application.

In Chapter 3, which is, as I mentioned, sort of the heart of NUREG-1927, it was greatly expanded in Revision 1. And this chapter includes the guidance on the aging management review and also details on the TLAAs and AMPs. We expanded guidance on identification of materials and environments for SSCs and SSC subcomponents. We added reviewer guidance for assessing environmental data, so that you can determine the service and the operating conditions of the SSCs.

We also expanded guidance on identification of aging mechanisms and effects to address valid sources of information that could be used by the applicant to identify the applicable degradation modes, including the use of inspection results, site-specific and industry-wide operating experience, consensus codes and standards, and also other applicable NRC guidance and generic communications. We expanded discussion on aging management review for fuel assemblies. We also expanded the TLAA guidance for identification and review of TLAAs. We expanded discussion on each of the ten AMP elements, and the ten AMP elements were already in Revision 0, but we expanded the discussion on each of the elements and what reviewers should be looking for in the renewal applications.

We also provided guidance on this idea of learning AMPs and the thought is that a learning AMP would continuously respond to relevant operating experience in the period of extended operation and the guidance discusses how applications should include plans for future and periodic reviews of operating experience to confirm the effectiveness of the Aging Management Programs or make any changes as needed. We also included a discussion of specific concepts that were proposed by industry in NEI-1403. And this is a parallel effort by industry to develop guidance for storage renewal applicants, which the NRC Staff is currently reviewing for potential endorsement, as Mark mentioned and as Kristopher Cummings will speak more to in his presentation.

The two concepts that we included in NUREG-1927 were the use of periodic assessments of operating experience in the period of extended operation, and these would be above and beyond the normal assessments of operating experience that are conducted as part of the licensee's quality assurance programs. We also included the idea of aggregating and disseminating operating experience across the storage industry, and that would be through the use of an operating experience clearinghouse or database. And so, Revision 1 provides reviewer guidance for applications that may use those concepts.

So, also in Chapter 3, we added guidance on how a pre-application inspection can support the aging management review by assisting the applicant in identifying what are the applicable aging mechanisms and effects, and it could also inform the development of the applicant's AMPs for their application. And as I mentioned on the previous slide, we expanded the discussion on the aging management review for fuel assemblies, and so this consolidated the Revision 0 discussion of retrievability.

Also in Chapter 3, we added a new section on commencement of AMPs for CoC renewals, and this links to the new Appendix F, which discusses storage terms for systems that are loaded under a CoC. And finally, we added a new section on implementation of AMPs, and this considers licensees and CoCs that may be in timely renewal and how that could impact the timing for their development of the infrastructure for AMP implementation, such as their procedures, and also actual implementation of different aging management activities that may be outlined in the AMPs. So, we did really make some extensive changes throughout Chapter 3 in Revision 1.

I'll now jump to the appendices in Revision 1. So, as I noted earlier, we did delete some of the appendices in Revision 0 that we found were not useful, but in their place, we did create some new appendices that we feel provides useful information to Staff and applicants. And one of the changes I want to highlight in appendices is in Appendix B. We developed three example AMPs.

One of them is for localized corrosion and stress corrosion cracking of welded stainless steel dry storage canisters. Also, we developed an AMP on reinforced concrete structures. And then finally, a high burnup fuel monitoring and assessment program.

The AMPs are based on consensus codes and standards where practicable. They do use achievable and actionable acceptance criteria and they also rely on the existing licensee's quality assurance programs and corrective action programs to maintain the SSCs' intended functions in the period of extended operation and take corrective actions as needed to do so.

And so, in conclusion, I just want to mention our path forward for NUREG-1927. We will await the ACRS letter after this meeting, and it sounds like maybe we may get that in a month or so time frame. And then after that, we'll make any final changes that are needed to Revision 1 of NUREG-1927 and then we would expect to publish that, and hope to publish that by June of this year. And my last couple of slides just include a list of references and acronyms that I use. So, I'll be happy to take any questions that the Committee has.

CHAIRMAN BLEY: Is there anything risk or accident release related thinking that drives this plan? I'm looking at a parallel plan for reactors, which in terms of paper is a lot more paper than you have here, but in terms of programs and the like, there's a lot of things I would think is similar and I'm wondering what drives the extent to which these aging management requirements have been developed. I didn't attend the Subcommittee meeting, so I missed out on those discussions.

MS. BANOVAC: So the Aging Management Programs, it would need to address any aging effects for the SSCs to make sure they continue to meet their safety functions. So, safety functions in Part 72 are sub-criticality, confinement, and also shielding, to meet those limits. So those are the three main safety functions. And we also include structural integrity, heat removal, and retrievability, to a certain extent. And so, depending on the component or the subcomponent's function, which safety function they're meeting, and sometimes they may serve several functions, any aging effects that could impact them meeting that safety function would need to be managed.

CHAIRMAN BLEY: Okay. So it's focused on all of the requirements that spin out of the regulation itself?

MS. BANOVAC: Yes.

CHAIRMAN BLEY: Okay. And no other kinds of considerations?

MR. CSONTOS: Well, let me add one thing. This is Al Csontos from the Staff. So, one of the things we did do is look at, we're not requiring every canister, 2,600-ish that are out there now, to be inspected. We're going through a sampling program, so there is a -- we're not risk-based, we're not using a full PRA right now type of deal to make our decisions, but we have risk-informed ourselves during the process of making these example AMPs to incorporate similar types of areas where there is like risk-informed ISI of different lines in reactors that are not as risk significant as a Class I or some other areas. So, therefore, what we did was we went through sampling approach for what we think would be okay. So, whereas it's not explicitly, it is implicitly included in our evaluation and in the Guidance.

CHAIRMAN BLEY: Okay. And that's -- I read this pretty quickly, but the sampling that's required is laid out in the NUREG?

MR. CSONTOS: The sampling is we're deferring that to the ASME code and qualification process, but we're saying that you don't need to necessarily inspect at one time all the canisters. You can have a criteria that you develop to looking at the various individual degradation modes and then, from there, you can then -- what you learn, that's where the learning aspect of the Aging Management Programs that we were talking about, whatever you find and you put into your Corrective Action Program, you will then have to expand or limit the types of exams that you're going to be expanding to later on, if you find something. But it's really one of, what you learn will impact how you gain your experience, that gaining experience goes into how you're going to do the AMP later on or updating the AMP or inspections and such. But the sampling, as of right now, we're not asking for all canisters --

CHAIRMAN BLEY: So this is kind of the learning AMPs thing that you mentioned, that's where that comes up?

MR. CSONTOS: Sure.

CHAIRMAN BLEY: Go ahead.

MEMBER RICCARDELLA: So is the ASME working on a case --

MR. CSONTOS: Correct.

MEMBER RICCARDELLA: -- or appendix?

MR. CSONTOS: There is a code case right now, Section 11, it's about 60 participants from vendors, NEI, DOE, ourselves, and all sorts of contracting organizations participating in that code case.

MEMBER RICCARDELLA: Under Section 11?

MR. CSONTOS: Under Section 11.

MEMBER RICCARDELLA: Thank you.

MR. LOMBARD: If I might add also, it's not a parallel effort, it's just another effort and initiative we have going on in the Division of Spent Fuel Management is to build a regulatory framework, risk-informed regulatory framework, for spent fuel storage going forward. And we have talked with the Subcommittee about that, we'll have a meeting in mid-May to talk with some of the --

MEMBER BALLINGER: I think it's May 18.

MR. LOMBARD: May 18?

CHAIRMAN BLEY: Oh, okay.

MR. LOMBARD: That's great and --

CHAIRMAN BLEY: Yes. We talked about that, it's been a year --

MR. LOMBARD: It's probably been a year since we first talked about that, yes.

CHAIRMAN BLEY: Yes, okay.

MR. CSONTOS: Right. And I think that's a good way to say, we are trying to figure out this process going forward, but at the time when we were starting to develop this, two and a half years ago, that was something we had on the horizon and we had to do something now to address the renewals.

CHAIRMAN BLEY: Yes. My memory is, you

just had the basics of the framework kind of laid out the last time we talked.

MR. LOMBARD: Kind of laid out, yes.

CHAIRMAN BLEY: Kind of laid out, yes. Tuned up a little from the first time and --

MR. LOMBARD: Yes.

CHAIRMAN BLEY: Okay.

MR. LOMBARD: Exactly.

MEMBER REMPE: So, just for clarification, some of the AMPs depend on research that's ongoing. Some of that research is funding through industry, EPRI or whatever, but some of it you cooperative with and some of it you participate to make sure that the results from that research come out correct, but could you elaborate which ones that you're actually -- are you doing some stand alone research for this? Could you talk a little bit about --

MR. CSONTOS: Sure.

MEMBER REMPE: -- some the R&D you did?

MR. CSONTOS: For the high burnup demo, for example, that is a DOE program, a research program. What we've done is, we've participated in the front-end of it. We cannot participate during the middle of it because we're doing the review of the cask that the high burnup fuel will be placed in and all the temperature and all the probes and everything that will be placed into. So, we have to recuse ourselves at some point. But at the beginning, to talk about what are the things that we would like as part of such a task and what kind of -- we like to call it, it's not research, it's more of a surveillance check. Similar to, as many people know, like the reactor pressure vessels, doing a surveillance check of the materials, because you go and you do a test after so many years of irradiation, see if the material properties are the same.

Well, in that case, it's similar in that regard to this case where what we're doing is we're setting this cask aside, putting high burnup demo in there or high burnup fuel in there, taking a look after ten years to see if anything happens. In the middle of that, what we said is, well, we would like to see gas samples to see if anything is happening or not. And so, these are things that we, at the front-end, said would be helpful to us. The industry went off through DOE to go and develop that program themselves. It's now before us for review for that specific cask at North Anna.

And so, that we can't talk about, because it's a separate review process, but we will be very interested in seeing what those results are in ten years because a lot of the licenses, the last two licenses to have as part of their AMP, one of them has a condition saying, we need to see what's going on there to then see what's going to happen for the high burnup fuel as it goes into the period of extended operation. And so, right now, the high burnup fuel that's being loaded, it has been very recent. And so, by the time we get the recent results, those high burnup casks that are out there now will not have gone into their period of extended operation because they wouldn't have -- so, that's why we're able to have this surveillance as a tool for us to go forward. So, I like to call it a surveillance check.

MEMBER REMPE: Okay. Now, with chloride induced stress corrosion, how does that work and how does NRC participate in that one?

MR. CSONTOS: Sure.

MEMBER REMPE: Which is also --

MR. CSONTOS: Right. Well, one other thing with the high burnup programs, we have our own internal research that we're doing with DOE on high burnup fuel performance at Oakridge National Labs. That's a separate entity all to itself so that we understand what the mechanical performance would be during transportation. So that's separate. Chloride SCCs, there is no formal coordinated effort right now with DOE or with the industry other than through the chloride SCCs RIRP program, that's through NEI. And what that is is a coordinated effort under the RIRP to look at all the different issues related to chloride SCCs and look at all the data available to us and look at susceptibility criteria and things along those lines. And that's related to that. We're going to have a public meeting on that probably some time in May to close that issue up, because we've been -- April 28, okay?

MEMBER REMPE: It's this NRC --

MEMBER BALLINGER: Joy, is your microphone on?

MEMBER REMPE: Oh, yes, that was turned away from it, but yes, does NRC have -- what is the role of NRC? Are they just reviewing it, holding public meetings, or are you actually funding research on that independently?

MR. CSONTOS: We are funding research in the areas of inspection right now, because we have done the work in the past, back in the 2005 to 2010 time frame, we had spent a few million dollars to look at doing crack initiation testing to see whether or not various types of events could cause it. In a corollary to that, we also went into all the databases, the operational experience databases for the reactor side, to see about how applicable they were to, these types of conditions, to the world. And we found several events associated with chloride SCCs. So to us, it became a real issue.

And what we're doing now is, we had worked since 2010, I believe, on this RIRP with NEI and the industry. That's the only formal process. We have other programs going on, but right now we have moved away from whether chloride SCCs could happen to how do we find if it is happening, which is inspection. And so, that's where the chloride stress corrosion cracking AMP is focused more on that because we, at this point, are looking to detect whether or not it is, I use the euphemism is it's sort of like, we need to know if we have the disease first before we go trying to fix anything, so let's go see and detect whether or not we have cracking on these canisters. We know that there are corollaries for the reactors, but do we have it for the canisters, it's a different application. We want to have that inspection capability and that's where we're putting our money at this point.

MEMBER REMPE: Thank you.

MEMBER BALLINGER: Question, these incidences of chloride stress corrosion cracking, did you just catalogue them or did you run each one to ground to find out how relevant a particular incident was?

MR. CSONTOS: Yes. So, we have run several of these to ground. Several of them were under insulation and under crevice locations under hangers, pipe hangers and things like that, and those were not as directly related, like for the insulation, but there are crevices on some of these systems and so the crevice locations, where the pipe hangers were, are relevant. In some cases we looked at, there are about half a dozen that are really analogous to what we're looking at, which were heated systems in 304 or 316 stainless, whether they're tanks or pipes, that were exposed without any hangers or anything, that have had chloride SCC.

MEMBER BALLINGER: Did you run the Schedule 10 piping issues to ground?

MR. CSONTOS: I'm not understanding what that one is.

MEMBER BALLINGER: A lot of the incidents on externally exposed piping that suffered chloride

SCC had to do with so-called Schedule 10 stainless steel piping.

MR. CSONTOS: Oh, yes.

MEMBER BALLINGER: In particular, probably San Onofre and Turkey Point, maybe, I forget, Crystal River or Turkey Point. Did you run those to ground?

MR. CSONTOS: We have, but we have also looked at the Koeberg Plant as well. That's the one that has the exposed stainless tanks. And I think that was a three or four, I believe. And the Koeberg Plant in South Africa, and it's very near the coast, and so, there are examples that are analogous to through-wall leakage of these for chloride SCC. So, again, though, even though it's analogous, I can't say exactly that it's a one-for-one, because these are heated systems, they're unique application, and so, at this point, we're focusing on the detection for whether or not this is happening to us.

MEMBER BALLINGER: Okay. Last question, is that Part 72 really, the rule states that you can't exceed the dose at the site boundary. Have you done the analysis to say, if I have a crack or a hole or whatever you want to call it, what's its effect on the site boundary rule? Have you done that?

MR. CSONTOS: We have not yet, we are

thinking about doing that in the near future here. But the other aspects to a cracked canister are not just for the dose, it's also -- we have to think about sub-criticality for a flooding event or something along those lines. We have to think about confinement in that way. We have to think about the thermal piece to it as well, because there are thermal requirements and the helium that's inside the canisters are there to help with the conduction of the heat away. And so, we have to think about all these things and associate them with the dose at the site boundary as well. So that's some of the things that we have to contemplate when we're looking at, what's the effect of a cracked canister?

MR. LOMBARD: Well, it's structural integrity of the system itself.

MR. CSONTOS: Oh, absolutely, yes. Thank you for that. Yes.

MR. LOMBARD: One thing that I will tag on to what Al said about NDE, about the inspection piece, is that we're really encouraging the industry to continue to develop devices that can detect cracks and the depth of cracks in stainless steel canisters, and that work has progressed pretty well. The first three pilots were done, actually four pilots now with Palo

Verde and then another one coming up, I think, at McGuire in May, right?

MR. CSONTOS: Right. We have two more coming up. In May we're going to McGuire to see the testing of a demonstration of robotics systems going into canisters. And also in July at Maine Yankee, it's a decommission site, and to see if they can do the same thing for a site that doesn't have an operating reactor.

MEMBER BALLINGER: Last, last question, or penultimate last question, are you collaborating or participating with EPRI? At the Subcommittee meeting, there was a slide for which they identified two tasks that they were performing and there were reports going to be issued. One of them was a consequence analysis for a leaky cask. Are you participating in that in any way?

MR. CSONTOS: Yes. That is part of the chloride SCC RIRP program. That's with NEI. NEI then works through EPRI to get their research arm to provide those results, research products to us. And then our -- I don't want to say research products, they're just technical products, to us. And then we tend to, what we've done in the past is review them, provide comments, they are not -- but we haven't reviewed and approved them as like a topical report review, full topical report review, it is more for putting it out there into the documentation for this area, chloride SCC.

MR. LOMBARD: And many of these activities are talked about at the EPRI meetings, the extended storage and collaboration program meetings, which the next one is May 2. And we participate extensively in that and provide input.

MR. CUMMINGS: Yes. Let me add to that. So, coming out of the Subcommittee meeting, we contacted EPRI about accelerating their schedule for doing the consequence analysis. So, they've already been committed to at least going out and first doing a literature review and, in my previous time with Holtec, I've done several consequence analyses, both kind of normal conditions and then also kind of more severe conditions. I've now gotten those entities that I worked for previously to share some of that information with EPRI so that they can kind of hit the ground running in terms of the methodology that they're going to use.

We're struggling with some of the same things that we've already talked with the NRC about, which is do we want to use dose as a metric? Do we want to use cancer fatality as a metric? What's the right metric so that we put this in the right context? I think we're going to have another meeting with the NRC in the near-term time frame to talk about the risk-informed framework and we'll be presenting some information there in terms of that consequence analysis that we're looking to have EPRI do.

MR. CSONTOS: And let me just -- one thing is that the RIRP is the Regulatory Issue Resolution Protocol. That's an NEI program. It's really well established, we wrote way back when in 2009, 2010 a full test plan, or not a test plan, but a plan to how to address this issue. And that's what we followed through. So it's been now about five, six years and we've gone through all of those documents that EPRI and NEI said they were going to develop, we've done our part. So it's been a good collaboration on trying to get this body of work to a place where we can make regulatory, how we're going to address this issue, basically, from a regulatory perspective. And what you see from all that work is the AMP. And the AMP for that is how we've come to that place. That's why it's a good place to close out.

MR. CUMMINGS: I think the most valuable process of that, or portion of that process, is it allows us to get reports to the NRC, allows you guys to comment on them, provide your feedback on it, but we're not necessarily asking for a review and approval, but it allows you to see the work that's out there, allows you to comment on it. We incorporate those comments to the maximum extent that's reasonable. It's worked now twice very well with the top nozzle stress corrosion cracking and then with CISCC, which we're going to be closing out here in the next month or so. We're looking at other things like the risk-informed framework to put into that RIRP process to work with the NRC. It's been a very good way to interact on a technical level with the NRC.

CHAIRMAN BLEY: That's good. I want to go way back to Mark's response to Al a little bit ago. You threw in the bin of things we're worried about in cask integrity or canister integrity, criticality. Now, I don't trust my memory, but I thought the designs for these were such that by geometry they shouldn't be able to go critical if they're flooded. Is that not true?

MR. LOMBARD: Go ahead, Al. Al's got an answer for that.

MR. CSONTOS: Yes, with the assumption that the fuel and the cladding remain intact. And that's part of an aging process that that's part of the high burnup demo program and everything else that we're --

CHAIRMAN BLEY: But it would have to get really, really unintact for that --

MR. CSONTOS: Yes. Really, really --

(Laughter.)

MR. CSONTOS: We're all well aware of that, but that's the answer to your question is that, yes, but with that caveat.

MR. LOMBARD: So all those things have to be taken into consideration together in an integrated fashion. One thing, Dr. Ballinger, that you mentioned is consequence analysis and we had a little discussion about that. As we talked at the Subcommittee meeting, driving force is what drives dose at the site boundary and beyond and once you have an initiation, unless you have the start of a through-wall crack, you'll lose molecules of helium over a period of time. And in some time period, you'll lose that driving force, even if you had some degradation, some cladding degradation.

So we know logically that your dose at the site boundary is going to be very, very, very, very small, but we've got to make sure that we do integrate our analysis of it and make sure that all the other important safety functions are considered as you look at through-wall cracks. So that consequence analysis has to be done very carefully and the assumptions have to be very clearly defined and implemented as you go through the analysis.

CHAIRMAN BLEY: Yes. That all makes sense, but I think you'd have to have some really extreme deviations from anything I consider feasible for this not to be true.

MR. LOMBARD: But then to look at the other, what happens after that? What other functions are you making sure that you maintain the important to safety functions going forward? And with an eye towards transportation, even though that's not the purpose, storage is storage and the storage period of extended operation are those for those that have been renewed, but you've got to keep an eye on transportation as well.

MEMBER BALLINGER: Last, last, last, last question. With respect to this consequence analysis, is there a thought to revising Revision 2 that feeds back the results of the consequence analysis and any other risk related stuff that you've done on alleviating or modifying, if you will, inspection criteria, things like that?

MS. BANOVAC: So I think --

MEMBER BALLINGER: Because that's the expensive part --

MS. BANOVAC: Yes.

MEMBER BALLINGER: -- doing the inspections.

MS. BANOVAC: And I think the -- I mean, the thought going forward, so we do have the three example AMPs that are currently in NUREG-1927, those are example AMPs. At the Subcommittee meeting, we talked about the MAAPs report that we're developing that will include some additional AMPs. So, of course, if any further work is done, we expect to update both MAAPs and NUREG-1927 to respond to any additional research, any additional work analyses that are done. The thought is that these are living documents, these are not frozen in time. And just as we expect these learning AMPs to respond to operating experience and information over time, we want our Guidance to do the same. So we want the Guidance to be living documents. And so, yes, they would consider any further work that was done, include a consequence analysis.

MR. CSONTOS: And let me just add, I don't think it needs a -- it doesn't need a change or a revision to 1927, I think it would just be a matter of changing the Aging Management Program that a licensee maintains to incorporate that risk element to it. So that's why I think that -- I think I mentioned this at the Subcommittee meeting, I don't believe 1927 is incompatible with a risk-informed approach.

I think we have taken a risk-informed approach, but if the licensees want to do an even more risk-informed approach, or they do some other analysis and they want to use it to change their time frames or whatever, that's part of the learning part of the Aging Management Program and that's up to them to decide if they want to change their AMP accordingly. So, that's why I think that -- I'm not sure it needs a whole revision change, it's already incorporated basically.

MR. LOMBARD: Al brings up a good point, that the regulatory framework is living and learning as it goes forward as well. And as we have -- as this thing was molded and shaped over the last two plus years, we've learned a lot as well when we went through the first two ISFSI renewals and the first CoC renewals, we've learned and have modified our approach so that more of this program is put into licensee control or stakeholder control.

MEMBER BALLINGER: That's because the rule -- this issue of confinement and the dose at the site boundary are somewhat inconsistent in the sense that it's entirely possible that you could breach confinement by crack and not even come close to the site boundary dose, which is what the rule says. And so, is there any thought to actually, based on this extensive analysis that goes on inspections and things, to thinking about what the rule says? There's a confinement -- because those SRPs for the casks say you have to maintain an inert environment for the life of the exposure. So that to me says, no leaks.

MR. LOMBARD: The short answer is, yes. What that looks like, we have to mold and shape that as we go forward. And we're learning too as we go forward and the paradigm shift that we've talked about, there's been kind of a pair of paradigm shifts recently with the second consolidated storage potentially, and that's why you have to keep that eye on transportation with consolidated storage.

But the first paradigm shift is that these systems are going to be sitting on the ground much longer than originally intended, so you've got to think not only in that first 20 year time frame, but potentially a 60, 100, 140 year time frame, even though your licensing review has to be restricted to that period of the extended operation that you're reviewing, but you've got to keep your eye on what happens in the long, long term. So, yes, confinement is -- we know that it's an important piece of our regulatory framework, but we've got to do the right thing going forward and plug reality into these decisions that we make regulatorily as much as possible.

CHAIRMAN BLEY: This discussion has helped me a lot because I didn't come to the Subcommittee meeting, I think primarily, that I didn't get just reading through the document. But what I'm hearing is, you see this as an evolving program and a lot of things to learn over time. Is there some kind of a prepared plan looking forward of how you expect this to evolve, what happens next, and how some of these things that were discussed get factored in to the ASME and maybe focus on site boundary and other things?

MR. CSONTOS: We have a plan that we talked about at the Subcommittee meeting where we have -- this is just the first part of the keystone. This is the keystone part of what we are going forward with. We're developing a GALL-like document, Generic Aging Lessons Learned type of report that looks into specific systems so that licensees will have the ability to just pull their system and see what we've already approved basically through that NUREG report. We're developing a Reg Guide to endorse parts of or the whole of 1403, as well as ASME code ACI Code for concrete and ASME code for the metal parts

And then we're looking at -- or the confinement boundary, the metal confinement boundary parts. And then the temporary instruction then moving to an inspection procedure because, as Mark alluded to, we're giving a lot of change control authority to the licensees, but we don't want to lose that oversight capacity to then make sure that licensees aren't saying they're just going to inspect no canisters in the future. Because at this point, we don't have many operational events or operational experience of inspections, we only have a few, and so we really want to get a better handle on what is happening and what's out there.

Right now, everything's looking fairly good, so that's a good thing, but we want to develop that basis a little bit better. And then the key part to the next step, where you're asking what's evolving, is the NEI concept of a tollgate. And the tollgate is this process that Kris was mentioning earlier, let me see, where is that, that periodic assessments, the last bullet. And that's a key concept that we do agree with NEI on and that is that periodically we're going to have these set aside type of meetings where we say, okay, what's happening? And then from there, we'll get a better handle of how and where we go with the living documents.

CHAIRMAN BLEY: Okay. I guess my whole set of questions here are kind of an unsettled feeling from a few things I heard, and some which I could infer from reading, that this could evolve into an aging program akin to that that we have for operating reactors, which would seem way out of proportion and would make it almost prohibitive to keep this stuff.

MR. CSONTOS: This is really in a lot of ways, it's a -- a lot of these things were already being done by licensees and we're just putting it to a -- formulating it into the AMP framework.

CHAIRMAN BLEY: Okay. Well, I look forward to seeing how this progresses, because I was jumping to conclusions I probably shouldn't have.

MR. LOMBARD: Well, the intent and the way it's billed is certainly to model the framework of what was done on the reactor side, we didn't want to recreate the wheel, but we wanted to take what does apply to dry cask storage, realizing the simplicity, if you will, of the systems themselves, especially compared to a nuclear power plant. These are passive systems sitting underground. And we realize that and we wanted to build a framework appropriately.

MEMBER BALLINGER: Dana? I'm giving you an opportunity.

(Laughter.)

MEMBER POWERS: Okay. I have a couple of questions to follow Ron on this subject. I guess one of the questions is that we don't know the source term should one of these casks fail very well, but we generally think it's low. At the time you're proposing this magnum opus of activity, we are at the same time proposing that the research reactors have unlimited licenses, with just an occasional update to the FSARs. And the basis for doing that is we say, gee, these research reactors have small source terms, they operate in -- they're simple, mechanically simple, and they operate in known hostile environments with respect to pressure and temperature. Well, all those elements of logic for the research reactor seem to apply to the casks.

The other question I have posed is, we know the source terms for these casks, again, we know them poorly, but we suspect they're small, if we're talking about a crack induced by stress corrosion cracking or things like that. On the other hand, we know that if a saboteur or a terrorist attacks them, they make big holes and create bigger source terms. And so I say, anything that we do to facilitate the inspection of these casks for cracks is fine, as long as it does not make them more vulnerable to attack or sabotage.

MR. LOMBARD: So you are probably aware that we did some, what we call proof of concept testing, two years ago, maybe three years ago, in the high desert of New Mexico. And we've proven that certain things could be done, but the fact that we delayed the ISFSI security rule for at least five years is an indication of what we think about those terrorist scenarios. They're not important at this time given the environment that we're in. And I'll not say more than that.

MEMBER BALLINGER: I mean, what I'm -- to expand on this a little bit, what we're thinking, hypothetically, we require inspections, which can't be made very easily for current casks, because they never were designed to be inspected in this way. So, subsequent cask designs get modified to be easily inspected, for inspections that really have no consequence, because the consequences of a leak are so small, but yet we've redesigned the casks to be more easily inspected. And in thereby doing that, we've allowed access, which we wouldn't have had before, which could be used for nefarious purposes. So, it's a reason to consider balancing the inspections that are required and any modifications going forward for casks that might come from that, like Dana was saying.

MR. CSONTOS: Yes. I think that -- we hear you and that's a good point. I think that what we've seen so far, and we can't really go into it, because they're under review now, with those options, it would do nothing like that. The best thing I could say is that it's not adding more access, it's just making it easier for things to get in, for small things to get in to do the inspections. That's a little bit more easily achievable than currently, but it would not do anything around that part of going there.

MR. LOMBARD: So, two things. The robotics are really to the point now that they're very impressive, it's just -- so the delivery techniques are very good, it's the inspection technologies that need to be improved along with that. And the new designs, as Al said, are not that dramatically different that it would change the scenarios. And I'd love to have a more detailed discussion with you all at some point if you'd like on that topic.

MEMBER BALLINGER: May 18?

MR. LOMBARD: Probably not that day, because we'll need to be in a different room, or maybe in this room after certain things were done.

MEMBER BALLINGER: Okay.

MR. LOMBARD: But we have done a lot of work and NSIR has some great presentations on that topic.

MEMBER BALLINGER: Any more questions to the Staff? Kris? Great. I think you should have an apartment here.

(Laughter.)

MR. CUMMINGS: I'll have to take that up with my boss and his budget. He says no. Great. Thank you very much. So, I'm going to give basically a recap of several of the presentations I gave to the Subcommittee in conjunction with NUREG-1927 and ISG-2, all kind of wrapped up in the context of a risk-informed framework. So, I'll start with retrievability. The first thing I want to point out is that these cask designs were basically designed to prevent or limit the degradation or damage to the fuel during storage. Like we've been discussing, there's an inert environment, they're dried using either vacuum drying or a forced helium dehydration process to essentially have no residual water in the canister.

The basket and canister design itself provides a very tight enclosure of the fuel assembly. I think there's something like a quarter inch clearance between the fuel assembly and the basket itself on each side, so even if you were to have some sort of damage to the fuel in a severe event, you're not going to -- I go back to how maybe damaged fuel was modeled in some of the casks, that they created this theoretic possibility of the fuel pellets floating in an optimum water moderator. That's not a credible scenario, but it was done as a way to bound it with the understanding that that was a very conservative analysis.

There's a limitation of the peak clad temp below 400 degree Celsius, realistically, we've seen out of best estimate calculations for the demo cask, this North Anna high burnup demonstration and research program, that realistically it's much lower. It's actually closer to 300 degree Celsius, if maybe not even a little bit below that, in that case. Natural events don't cause a significant amount of stress to the fuel itself. All the natural environmental phenomena, tornado missiles, which include telephone poles and cars and things like that, these casks are large, they're 150 to 180 tons, that's a lot of mass inertia that would need to be moved before you could do any damage to the fuel.

And the confinement boundary itself prevents water from ingressing into, in the same way that it prevents radiological contents from being released. There are technologies that exist that are able to handle fuel with either gross ruptures or structural defects. I go back to my experience when Trojan was loaded, they had fuel assemblies with severed rods, parts of the rods were missing, and they had undergone a campaign in their spent fuel pool to pick up fuel pellets off the bottom of the spent fuel pool. And they put those into two debris cans that then had ten or 15 or 20 pellets in them. We're able to, what I would call play pick-up sticks with damaged fuel assemblies in a safe manner, both to the public and to our operators.

So, basically in conclusion with retrievability, we look very favorably on this change. I do point out that this is where we started, Rev. 0 was basically as long as you can go get the cask, prepare it for transportation, and ship it to a facility where you would be able to process it, whether that's for additional storage or for disposal or for something else, then we think that's a good use of risk-informing and performance-based criteria to apply retrievability in the way that the NRC has defined it. So, next I want to talk about NEI -- yes?

MEMBER RICCARDELLA: Talking about natural events, could you comment on seismic events?

MR. CUMMINGS: Yes. The casks are designed for seismic events, at least in terms of the cask certificates, those are analyzed for seismic events anywhere in the United States. If for some reason they need a high seismic cask, there may be some limitations for high seismic locations, but those locations are also designed for the design basis earthquake in those locations. The site would have to show that their site earthquake is bounded by the analysis that's done by the cask vendor.

MEMBER RICCARDELLA: Are they being updated for the new ground response spectra?

MR. CUMMINGS: That's a good question. I know that question has come up in the past. I would need to get back to you on an answer to that. Next I want to talk about NEI-1403, which has been discussed a little bit. This was something the industry put together in anticipation of the NRC revising NUREG-1927 and in large parts, were consistent with what they've put into 1927. There's really four cornerstones here, which I'll talk about. The first being the format and content of the actual license application that's submitted by either the CoC holder or the site-specific licensee to the NRC. That's basically getting the right information and the information that the NRC needs to make a safety determination.

Second is an operations-based Aging Management Program that relies on learning aging management activities. That's really acquiring the information as we go through the period of extended operation. The third cornerstone is a sharing of that operating experience throughout the industry, and that's through this AMID database, Aging Management INPO Database, which I'll talk about a little bit more. And then, finally, as kind of the looking at on a periodic basis of what we're doing and is it the right thing or are there things that we can, especially in a risk-informed manner, are there things that we should be focusing our attention on more? And that's through this periodic tollgate safety assessments that will be done by the individual licensees for their specific site.

So, I won't go into a large amount of detail, this is really the format and content of the license renewal application. Sections 1 through 3 are essentially the same as what's in NUREG-1927, and then of course there's a recognition that you can do a time limited aging analysis to justify that you don't need an Aging Management Program because of various aging mechanisms would not cause a loss of safety function over the period of the license for which the license is being reviewed.

So, the operation based aging management, it's really characterized in the learning aging management program. It's the ability for us to go out and as we get more operating experience, we get more inspections, we have more research, whether that's done by the NRC, the industry, DOE, international research organizations, that information feeds back into the Aging Management Programs on, as I'll get to later with the tollgate process, on a periodic basis. And that's achieved through a couple different things.

The first I want to talk about is the current licensee inspection and maintenance programs. So, currently, ISFSIs do dose monitoring, at a minimum at the fence. They have TLDs, thermoluminescent devices, that measure dose. They check those on a quarterly basis. Second, there's cask systems that are open to the environment and have vents on them. They do periodic inspections of the vents. That is a daily inspection, or sometimes actually some of them do it twice a day, although a lot of licensees actually have a temperature monitoring system that they've installed on the cask, which take the place of that.

So rather than a person going out every day and looking at the events to ensure that they're not blocked, they have simply a temperature, I'm trying to think of the word, a temperature monitoring device that measures the temperature and then typically the delta T between the inlet and the outlet. And that is provided to the control room. And then, third is a yearly preventative maintenance task. So that's looking at the cask exterior for concrete scaling and cracking, looking at the closure bolts for corrosion, and those are done on, at a minimum, a yearly basis.

So, second is the learning aging management programs, as we've talked about, defining the Aging Management Programs through the license renewal application, which are then described in the FSAR. Those set the baseline for the types of inspections and how frequently you would do them, certainly, and then what you would do if you start seeing something. Having the ability to look at those on a periodic basis and modify them to either, from a risk-informed perspective, reduce the frequency because you're not seeing anything and you've got other operational experience that shows that you wouldn't be seeing anything, but also if you do see something at another site, a secondary site, saying, hey, look, they've seen something, maybe we need to go back and evaluate whether we need to be doing that inspection on a more frequent basis.

Third would be the NRC inspection programs. We're very much looking at ensuring that the NRC inspectors that are at the individual utility sites, making use of their ability to inspect the procedures and inspect the results and I know they work very closely with the White Flint office here in terms of, if they're seeing something, to work with the technical experts here at the NRC main offices. And then, finally, as Al alluded, putting more control under the licensee, having a trusted and reliable 72.48 change process. And I think that's really in the paradigm of both sides, the industry and the NRC, both understanding how that process works and having a consistent understanding on how that process works.

MEMBER BALLINGER: I have a question. I probably maybe should wait until the end, but it's burning me.

(Laughter.)

MEMBER BALLINGER: These current monitoring systems, you had a crack in one of the canisters that was a through-wall crack, would any of these systems find it?

MR. CUMMINGS: There's been some discussion of that. I know Jun Lu from Argonne gave a presentation at the --

MEMBER BALLINGER: The temperature thing, yes.

MR. CUMMINGS: Right. That's not specifically what they were designed for. So I don't know that I could give you a firm answer as to say, would it definitely be able to tell you that? I think they've made a case that it would, that you would be able to use some sort of a temperature monitoring device to say, okay, if you've now exchanged the helium in the cask for air, that's going to change the thermodynamic properties, and that may cause a larger temperature delta between the inlet and the outlet.

MEMBER BALLINGER: What about the vent monitor? That's, I presume, radiation monitoring of some kind.

MR. CUMMINGS: The vent monitoring is simply ensuring that the vent is not blocked --

MEMBER BALLINGER: Oh, okay.

MR. CUMMINGS: -- by tumbleweeds or dirt or snow.

MEMBER BALLINGER: That could be used to do a particular -- to detect a leak, could it not? By some kind of air sampling technique or something like that?

MR. CUMMINGS: I think if you were doing some sort of air sampling technique, it might be able to. I think there you would be looking at some sort of air sampling, put it on the vent or someplace else. That's not something that's currently done. The dose monitoring is really based on the TLDs on the ISFSI fence. But that's for showing compliance with 72.104, the 25 millirem at the site boundary.

MEMBER BALLINGER: But some combination of delta T measurement, that would be an indicator, and then go inspect, put something on the vent, an air sampling system, might work.

MR. CUMMINGS: It could work.

MR. CSONTOS: I think I saw Darrel Dunn in the audience over here, he could answer that because we did do a report on monitoring technologies. I think that was maybe two years ago. You want to say anything, Darrel, about that?

MR. DUNN: This is Darrel Dunn from the Division of Spent Fuel Management. We did look at that and I think the conclusion was that trying to detect, I think what was looked at was, could you detect helium? Because you know that's going to, if you have through-wall crack, you know that's going to leak out of the cask. And that turns out to be not as easily detectable as you might think in the outlet vent. It would be just really very diluted, especially if you had appreciable airflow going through there. So, it --

MEMBER BALLINGER: Helium would --

MR. DUNN: -- may or may not be able to detect a through-wall crack.

MEMBER BALLINGER: Helium would not be my most important thing to look at.

MR. DUNN: Sure.

MEMBER BALLINGER: I'd be looking at some radioactive emissions, radioactive particles and stuff, that --

MR. DUNN: Well, you would probably be looking for a fission product gas, is the most likely thing that if you were talking about something radioactive coming out, it would be that, versus a particle.

MEMBER BALLINGER: Okay. All right.

MR. CUMMINGS: All right. So, the third cornerstone is this ISFSI Aging Management INPO Database. So, this was put together between the four major cask vendors, AREVA-TN, Energy Solutions, Holtec, and NAC International. They've agreed in collaboration with INPO to essentially develop a database where various operational experience from aging management would be captured. So this will be the inspections that done through the Aging Management Program, whether it's CISCC inspections on the canister, whether it's concrete inspections, any of those would be put in.

Certainly, the results that we have to date, the inspections that were done at Diablo Canyon and Hope Creek, and I know there's another one, Calvert Cliffs, those would be put into the database once we get this up and going. This is not a replacement of the Corrective Action System, this is basically a warehouse for the information. The licensee who creates the information, be it a research organization or a licensee like a utility who does an inspection, they'll have the QA record, but this will really give one place where licensees, cask vendors, can go to to get the conglomeration of the operating experience and data that's out there.

It will be available to all of the CoC holders and licensees. And it will include both positive and, what I would call negative information, negative being, we've seen something, we've seen some corrosion, we've seen some indication of corrosion, or something more than that. But obviously if you go out and get an inspection and you say, hey, look, we went out and looked at the canister and we really didn't see any surface corrosion, we didn't see any pitting, and we didn't see anything else, that's good information to have too because that feeds back into the Aging Management Programs, especially across different sites, as we start to get this information I think it will allow us to start seeing where are really the concerns?

I mean, I think we already know marine sites with a chloride source, those are things that we need to be aware of CISCC specifically, but I'm also very interested in ensuring that those sites that don't have a chloride source, they're in the middle of the country, they don't have other chloride sources, that they're not doing inspections every five years simply because this has been a concern generically. Certainly every plant has different Aging Management Programs based on their specific site geology and atmospheric conditions at their site, we're trying to make sure that we have a similar sort of flexibility in the context of casks, especially in the context of the frequency of the inspections.

MEMBER RICCARDELLA: I would assume the ASME code work would take that into account.

MR. CUMMINGS: Yes. We've been asking the ASME code to specifically look at those sorts of things.

MEMBER BALLINGER: I have to say this, I just got an email from the NRC that says, Dry Cask 101, Making Sure They Hold Up. It's a blog over dry cask storage.

MR. CUMMINGS: Good timing.

MEMBER BALLINGER: Good timing.

MR. LOMBARD: We have a whole series of blogs that are going out on dry cask storage actually.

MR. CUMMINGS: All right.

MEMBER BALLINGER: And I have a question. I'm a little slow, back for Darrel. Earth to Darrel.

(Laughter.)

MEMBER BALLINGER: You're saying that if you have through-wall crack you probably would find it?

MR. DUNN: Well, the monitoring techniques that we looked at in that previous monitoring report that Al was mentioning was focused on helium. Keep in mind, helium leak rate detection is a pretty tried and true technology, we use it on dry cask and it can be small enough to actually be usable. So, that was the effort to look at that. And the conclusion was that it would be very difficult for that to be detected. But your question is different, you're saying, if you had a through-wall crack, would you be able to detect it?

MEMBER BALLINGER: Right. By the presence of radioactive emissions of some kind.

MR. DUNN: I don't know that we looked at that specifically.

MEMBER BALLINGER: Yes. Because that's the good news and the bad news, actually. I mean, the good news is that -- well, the bad news is you might not see it. The good news is you might not see it, because that means that the leak rate or emissions would be very, very, very low, which goes to the source term issue that Dana was talking about.

MR. DUNN: Yes. So, it would -- there are a number of factors that would have to be considered there. What's the temperature of the cask?

MEMBER BALLINGER: Yes.

MR. DUNN: What's the pressure differential? How big are the cracks? How long have the cracks existed? If they've existed for a really long period of time and you go to the modern tech now, chances are they could be there and you wouldn't detect them at all because whatever fission gas you had in there is gone. That doesn't mean you don't have cracks.

MEMBER BALLINGER: But could you violate Section 11 before you saw it? Because that's what the original analysis was for. You have a crack big enough before an accident event results in you not being able to maintain integrity of the cask during an upset of some kind.

MR. DUNN: So are you asking, could you get a crack big enough that you would basically exceed the critical flaw size --

MEMBER BALLINGER: Right.

MR. DUNN: -- if you tried to move it? Very unlikely.

MEMBER BALLINGER: Okay.

MR. LOMBARD: One thing Darrel said when he was up the first time is the dilution factor, you've got to take that into account as well. The vents are large. The flow rates, especially once they're first loaded, are very large. Of course, you probably wouldn't have an SCC crack when they're first loaded because they're too high. But there are a lot of factors there to take into account. And plus, once you start to get a crack, the stress is relieved in that area --

MEMBER BALLINGER: Okay.

MR. LOMBARD: -- at least.

MEMBER BALLINGER: Yes. I --

MEMBER RICCARDELLA: But if it's so low you can't detect it, then obviously the consequences aren't very severe.

MEMBER BALLINGER: That's what I'm trying to get at. I was saying, it was good news, bad news. I mean, the bad news is you can't see it, the good news is that you can't see it.

MR. CUMMINGS: Agreed. We fully agree with that, yes. Okay. So, the tollgates, they're basically a commitment to do a periodic document safety assessment by each licensee. It really -- what it does is the licensee will go out, they'll go to the AMID database, maybe other places where they get information, they may have their own inspections, although that would be put into the AMID database. They look at the bulk of the information and then do an assessment of their Aging Management Programs that were put into the FSAR. And then they make a determination where, okay, have we confirmed that our Aging Management Programs are the right ones? Are we doing them on the right frequency? And they would do that documentation, pay the toll, and then basically go through the tollgate. Their toll is doing this safety assessment.

MEMBER RICCARDELLA: Sorry. What's the period you're in?

MR. CUMMINGS: The period would be ten years. That's what we've proposed. And then, obviously, if some OE is out there that is come that is also applicable to your site, you would then implement corrective actions and, if needed, you would modify your Aging Management Programs as needed. These were piloted in Calvert Cliffs and the Prairie Island license renewals, however, in those cases, they were tailored to specific issues.

So, if you look at the high burnup tollgate that's in there, there they, for the high burnup, they have a specific date by which they need to evaluate the results of the high burnup demonstration program at North Anna. And I think there's some hooks in there that if that information is not available, then they need to go out and do something themselves or make an assessment themselves in terms of the continued integrity of the high burnup fuel that they have in storage. And there's a specific date in the case of that license for that specific tollgate that's in there.

So, in conclusion, having an efficient dry storage licensing process is essential for managing our growing and aging dry cask storage population. We have some 2,500 casks currently loaded. We load another about 200 per year. And with some recent shutdowns of plants, we'll be up in the 3,000 to 3,500 casks by 2020. We'll have a lot of casks loaded in the next five years. The things that we've been talking about today in terms of retrievability with ISG-2 and having a flexible and efficient license renewal process we think are good examples of how the NRC has been applying a risk-informed framework on these specific areas.

We would like to certainly see, and I think we had some plans to have some discussion with the NRC on looking at the entire dry storage framework. And I think a lot of the questions that you guys have raised in this meeting and in the Subcommittee meeting has really brought that to a head. The question that, it was I think maybe Dana that asked, which was, what's the risk of doing the inspection versus you didn't do the inspection and you have a leak or you didn't have a leak, what is that risk balance? And that's something that we're actually very encouraged to see the NRC picking up and having more discussions with the industry on.

MEMBER SKILLMAN: I wanted to ask you to back up one slide, please. Dennis, this is to kind of get to your question about, is this really a living program? What we challenged at the Subcommittee meeting was whether or not this idea of a tollgate has an E-ZPass. And the answer is, no. You really do have to do it. You really have to do the evaluation to get past go for the next stretch. So there's no E-ZPass, you've got to do the work.

MR. CUMMINGS: Agreed.

CHAIRMAN BLEY: I won't compare this NEI

presentation to us to some of the others, but I'm thinking of some of them, and you haven't objected much to what we see happening. Was most of this going to be going on anyway in your thoughts at these sites?

MR. CUMMINGS: In terms of inspections?

CHAIRMAN BLEY: Yes.

MR. CUMMINGS: Well, I mean, let's use the, I'm trying to think -- short answer is, yes. I mean, if I look at some of the licenses that were renewed prior to NUREG-1927 Revision 1, they have, even compared to what's being proposed in Rev. 1, they have limited Aging Management Programs. Now, they're still doing inspections, they're still doing maintenance, they're still making sure and going out. Now, they're a little different in that they don't have high burnup fuel, so there's even less risk on that part.

But we think it's prudent to ensure that we do have some level of inspections, we just want to make sure that those frequencies and the types of inspections that we're doing are the right ones and are being done for the right reasons. And so, that's what we really focused on, not do we need to have Aging Management Programs, but are we doing those in the most cost effective way that ensures public health and safety?

CHAIRMAN BLEY: And the exact requirements for the AMPs are still evolving.

MR. CUMMINGS: They are. I mean, we provided a lot of comments on the specific example AMPs that are in the NUREG-1927 and the NRC came back and said, they're exactly that, they're examples. We see that there is a responsibility for the cask vendor to, if they can make a case for a certain frequency or not doing an inspection, if you design the cask or you're in a certain location where you don't have a chloride source, I think a licensee could make a case to the NRC, if they find it acceptable, to say, you wouldn't need a canister inspection in the first 60 years, because you're not in an environment where CISCC would be a degradation mechanism. But there would have to be a case that would be made for that.

CHAIRMAN BLEY: Okay.

MR. CSONTOS: I make it akin to coarse chewing right now. We're coarse chewing it right now. There are some licensees who did inspections beyond what we asked. We just had a public meeting two days ago from Trojan on their decommissioned, their ISFSI pad. And they already have been doing inspections with a borescope that they put in and they've done them twice already. We didn't know that. That was something that wasn't an NRC requirement, they did it anyway as part of their site procedure.

North Anna, we had a meeting two weeks ago, they did visual inspections. All we did was ask them to do it, qualify their inspections. These are the things that -- right now, some of this stuff has already been done, we're just saying, hey, to make it official for NRC approval for what we're talking about here in terms of AMPs is qualify your inspection technique. In this case, North Anna went out, we had a pre-application meeting, they said, hey, well, how are we going to qualifying it? We said, use the ASME code qual card for a visual inspection. All they did is take their system, use a qual card, and now it's qualified.

So, it's nothing -- we don't see it as a huge, gross change or large change. This is just getting things in the proper place, putting it into the AMPs, things along those lines that's already being done. And for those systems, there is a requirement in the regulation that they have to be inspectible. And so, the systems that are out there now, they are all built to be inspectible. They didn't have it as a primary function, but then now we're finding out that some of these are more difficult to go inspect, but nonetheless, it's just a robotics issue. It's not, you're going to have to move the canisters or you have to move it, these are -- it's not as onerous as it sounds right now. Later on, we'll do the fine tuning, the chemistry, what's local. Once we get some more data points to make some decisions, then we'll be able to fine tune it and say, oh, yes, those plants of that area, there's a no, never mind.

CHAIRMAN BLEY: And I guess we're seeing things might be gaps in safety and pushing to plug them here, at least I'm sitting here thinking, it's smelling like overkill. I don't know. And I haven't heard complaints, we'll all go out of business because of this, or anything of that sort.

MR. CUMMINGS: Well, but I think --

CHAIRMAN BLEY: It will also be interesting and I think everybody's got to be really careful going forward.

MR. CUMMINGS: I think the flexibility was by far the biggest thing that we were asking with the NRC, was don't put these inspections in the certificate themselves, don't put them in the license, allow, like we have on the plant side, to have a learning aging management program or for the licensee under the NRC approved processes, be it 72.48, the inspection program, the QA program, for them to be able to learn or make use of the information that we get as we go forward.

CHAIRMAN BLEY: But that opportunity sounds good and I look forward to seeing how this turns out. I'm interested in the safety side, but every once in a while I get nosy about the cost of things, all this stuff is piling up because we don't have a place to put it. And wasn't there a big suit a few years ago from many of the utilities against DOE about, hey, they're not taking this stuff and we've got to do something. I don't know how that turned out. Is DOE paying for this?

MR. CUMMINGS: The utilities continue to file lawsuits against DOE for lack of performance on the standard contract. Those continue to be awarded generally in the utilities favors. That actually does not get paid by DOE, it gets paid out of the DOJ Judgment Fund.

CHAIRMAN BLEY: Okay.

MR. CUMMINGS: So every taxpayer --

CHAIRMAN BLEY: So there's money coming to the --

MR. CUMMINGS: Yes.

CHAIRMAN BLEY: -- utilities?

MR. CUMMINGS: Yes. Now, they don't get everything back.

CHAIRMAN BLEY: Yes.

MR. CUMMINGS: A lot of that depends on whether you have a -- how good your lawyers are and how good the DOE's lawyers are, but in general they do get a lot of it back. But they don't get 100 percent back of what they spent on storing, but I imagine a lot of this stuff will go into the lawsuits too.

MEMBER RICCARDELLA: But they're no longer paying the tax, the long term disposal fee, right?

MR. CUMMINGS: Yes. The fee was zeroed out a year and a half or so ago. But the Nuclear Waste Fund continues to grow through interest, I think it gains about $750 million a year. And the only thing coming out of it is --

MEMBER RICCARDELLA: They gain $750 million?

MR. CUMMINGS: Yes. There's $32 billion or something in it.

CHAIRMAN BLEY: Well, there's a big pot of gold.

(Laughter.)

MR. CUMMINGS: Yes. I think there's a

bunch of IOUs somewhere in a suitcase.

CHAIRMAN BLEY: Good luck on getting them back.

MEMBER BALLINGER: In conversation between two high-powered lawyers, myself and Al, we opined that if it was an NRC mandated inspection, then the money could be recovered. Is that --

MR. CSONTOS: That's what I was told by some folks --

MEMBER BALLINGER: Okay.

MR. CSONTOS: -- from the industry side, that if it wasn't a requirement and it was an option, they may not get that money back.

MR. CUMMINGS: I'm going to leave that one to the lawyers.

MR. CSONTOS: Yes.

(Laughter.)

MR. CSONTOS: That was from our discussion with certain lawyers for the industry, yes.

MEMBER BALLINGER: Any other questions? It's been a great exchange. I think we should open the bridge line, if we can make that happen? While that's happening, is there anybody in the audience that would like to make a statement? Technologed into stunned silence. It's open? The bridge line -- if there's somebody out there on the bridge line, could you make your presence known by just saying something?

MR. DOLLEY: We're here.

MEMBER BALLINGER: Wait a minute, is this a movie?

(Laughter.)

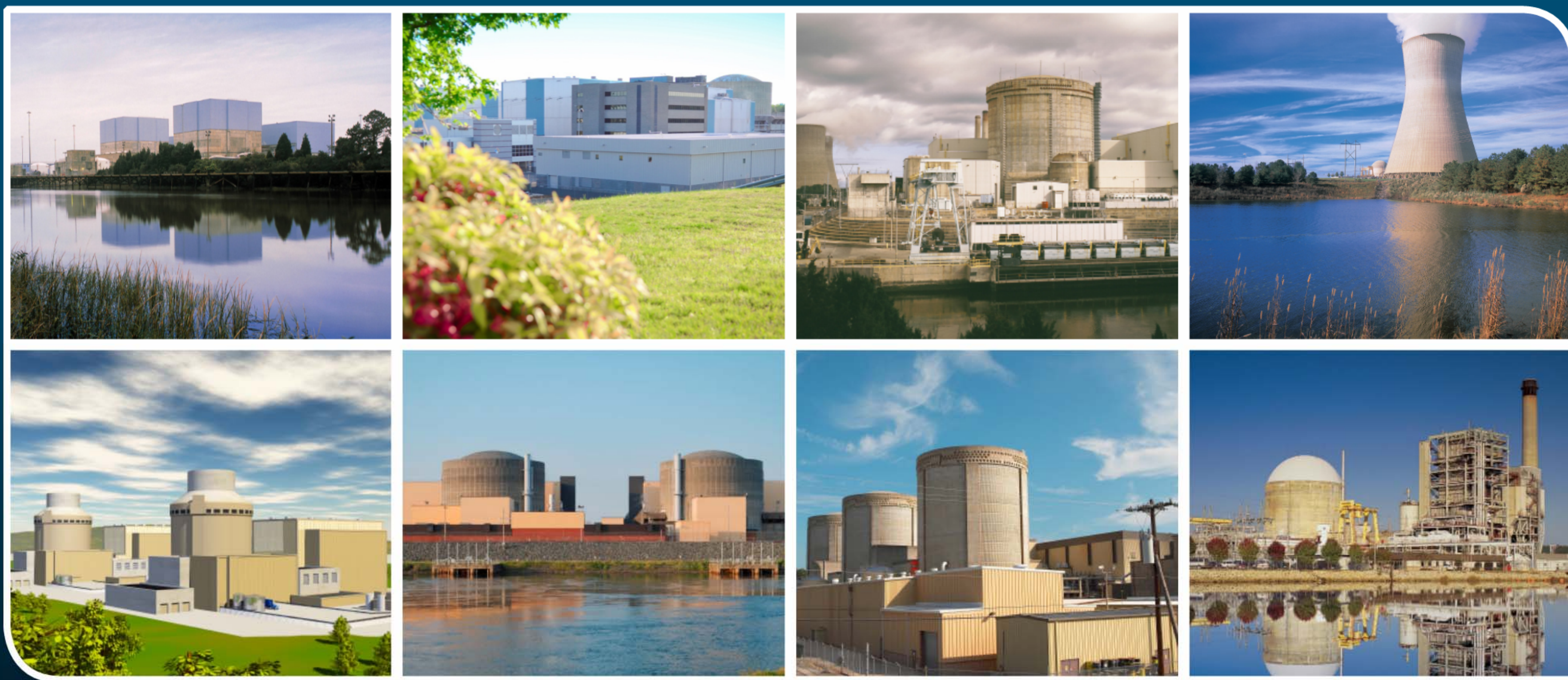
MEMBER BALLINGER: Who is this? Would you like to make a statement?

MR. DOLLEY: This is Stephen Dolley, with Platts. I don't have a statement. I have questions, but questions are not allowed.

MEMBER BALLINGER: Thank you. Is there anybody else on the bridge line that would like to make a statement? Hearing none, we can close the bridge line and turn the meeting back over to the Chairman.

CHAIRMAN BLEY: Thank you. Thanks everyone for your presentations. We're going to go off the record at this point, but we have a little more business before we take a break.

(Whereupon, the above-entitled matter went off the record at 3:40 p.m.)



Levy COLA – ACRS Review

AP1000 Generic Issues

DUKE ENERGY®

April 7th, 2016

Bob Kitchen – Duke Energy
Andy Pfister – Westinghouse

AP1000® PXS Condensate Return

Reason for the Design Change

- Previous analysis performed during design certification assumed a constant condensate return rate of 90%
- Investigations resulting from validation of this assumption determined the 90% return rate could not be met.
  - A result of as built design configurations that were different than testing used to establish the 90% return rate
- The safe shutdown temperature criteria in SECY-94-084 of 420°F in 36 hours could not be met with the calculated value of return rate without modifications.
  - Without the design enhancements, ADS actuation would have been sooner following a non-LOCA event. Adequate core cooling would have been maintained

Summary Of Design Change

- The following plant changes have been incorporated to increase condensate return to the IRWST
  - Add downspouts to polar crane girder and internal stiffener to drain condensate directly to IRWST
    - Minimizes losses associated with re-attaching flow to containment wall and with flow over support plates
  - Optimize IRWST gutter design and location
    - Extended to collect above upper equipment hatch and personnel airlock
  - Changed routing of cables to hydrogen sensors
    - Reduces quantity of support plates (obstacles) attached to the containment dome

- Licensing basis would not have been met without design changes

Safe Shutdown

GDC-34 Requirements

- A residual heat removal (RHR) system must be provided to remove residual heat from the reactor core so that specified acceptable fuel design limits (SAFDLs) and the design conditions of the reactor coolant pressure boundary are not exceeded
- Requires suitable redundancy of the components and features of the RHR system to ensure that the system safety functions can be accomplished, assuming loss of offsite or onsite power, coincident with a single failure.

Safe Shutdown

SECY 94-084 states:

- 420°F is a safe, stable condition for passive plants.
- Other plant conditions constitute a safe, stable state as long as reactor subcriticality, decay heat removal and radioactive materials containment are properly maintained for the long term.
- Passive system capabilities can be demonstrated by appropriate evaluations during detailed design analyses, including
  - A safety analysis to demonstrate that the passive systems can bring the plant to a safe stable condition and maintain this condition and
  - No transients will result in the specified, acceptable fuel design limits and pressure boundary design limit being violated

Safe Shutdown - AP1000 DCD Revision 19

- AP1000 DCD revision 19 has inconsistencies
  - Section 6.3.1.1 “Safety Design Basis” describes PRHR closed loop, “…capability to establish safe shutdown conditions, cooling the reactor coolant system to about 420°F in 36 hours.”
  - DCD analysis that demonstrates 420F in 36 hours is not a design basis analysis
- AP1000 DCD revision 19 supporting analyses demonstrate
  - Design meets GDC 34 requirements using Design Basis Analysis (Chapter 15) assumptions
  - Design achieves 420°F in 36 hours using conservative, non-bounding assumptions performance analysis
- Design description revised to establish clear separation of safety design basis from non-safety design features (Performance goal)

Issues Addressed

- Calculation Model Reevaluated
  - Error correction (Spreadsheet vs. LOFTRAN)
  - Simplification
  - Use of LOFTRAN with potential for two-phase flow
    - Heat loss vs. adiabatic analysis assumptions
- Design Basis Accident Extended (DBA) to 72 hours
- Safe Shutdown Analysis Confirmed
  - System capability to cooldown to 420°F in 36 hours
- Long Term PRHR Operation Capability Reevaluated (not indefinite)
- Operational Impacts Assessed

Analysis Conclusions

- Design basis analysis demonstrates:
  - PRHR closed loop cooling can maintain the plant in a safe stable condition for 72 hours

- Conservative, non-bounding analysis demonstrates:
  - PRHR closed loop cooling can cool the RCS to 420°F in less than 36 hours
  - PRHR closed loop cooling can maintain safe shutdown (<420°F) for at least 14 days
  - Adiabatic analysis of the RCS is appropriate

Summary of Licensing Basis Change

DCD Revision 19	Levy FSAR
1. For non-LOCA events, PRHR performance meets all Chapter 15 analysis requirements	1. FSAR Chapter 15 design basis accident analysis extended to 72 hours
2. Safety design requirement that PRHR cooling can achieve safe shutdown in less than 36 hours.	2. No change in analysis method. FSAR clarifies that this is non-safety design requirement based on conservative, non-bounding analyses
3. PRHR cooling can maintain safe shutdown (SSD) indefinitely.	3. FSAR identifies that PRHR closed loop cooling can maintain SSD for at least 14 days based on conservative, non-bounding analysis

Summary of Phase 1 Testing

- As discussed on Tuesday, Phase 1 testing was performed in 2013
  - Developed a uniform film flow toward obstacles
  - Used to substantiate 18% losses on CV shell
  - Testing conducted over range of expected plant film Reynolds numbers
  - Losses from CV dome rainout phenomena were taken from literature. Inclination angles ≤ 12° assumed 100% loss

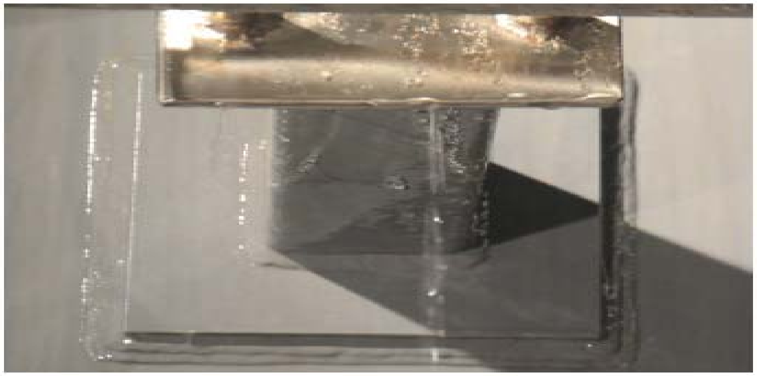
Phase 2 Test Facility

- Testing was conducted for potential margin recovery
  - Phase 2 testing (2014) was not utilized in licensing submittal
- 8.5' Diameter
- 16' Height
- Rated Pressure 60 psig (**AP1000** containment design 59 psig)
- Rated Temperature of Shell 310°F (**AP1000** CV Shell 300 °F)
- Developed to show benefits in losses as a result of a condensing film flow as compared to fully developed film flow from Phase 1 testing.

Westinghouse

Summary of Phase 2 Testing

- Condensing film flow showed:
- 10% losses at ∠ ≥ 12°
- 0% losses at ∠ ≥ 33°
- Plant welds at 5.8°, 12°, and 33°.
- **Analysis assumes 100% loss on transverse welds for ∠ ≤ 12°**
- Losses on lateral support beams/structures were bounded by 60% loss **as compared to assumed 100% in analysis**.
- Flat Plates at angles of 90° with weld seams did not experience losses.
- Benefits in Phase 2 testing were observed as a result of the differences in condensing film flow as compared to fully developed film flow.
- Observations were:
  - condensing films resulted in a wetted surface which was better for film to remain attached
  - Condensing films showed more pronounced "rivulet" behavior which also provided for better attachment behavior



Westinghouse

Other AP1000® Emergent Issues

- Post Accident Main Control Room Operator Dose
- Hydrogen Venting Inside Containment
- Flux Doubling Compliance with IEEE 603
- Main Control Room Heat Up

Post-Accident Main Control Room Dose

Problem Statement:

- The certified design did not include direct dose contributions from the VES filter unit: direct filter dose increase the operator dose when considered
- The Main Steam line break analysis did not model the most limiting release scenario: secondary side coolant release timing assumptions were non-bounding
- Discrepancies were identified in the underlying shielding calculations for post-accident operator dose: AP1000 shielding design non-conservatively differed from the analysis model

Issue Resolution:

- A combination of design and analysis changes were needed to demonstrate operator doses satisfy General Design Criterion (GDC) 19
- Reported doses decrease from DCD Revision 19

Hydrogen Venting Inside Containment

Problem Statement:

- **AP1000** design changes to containment layout were implemented without revision to supporting analyses for hydrogen diffusion flame
- In one particular severe accident scenario (frequency = 6E-9/yr), a hydrogen diffusion flame may create a locally high temperature near containment pressure boundary, hatch and penetrations
  - Analysis required to verify a containment survivability
  - ITAAC revision is required to reflect containment layout design changes

Issue Resolution:

- Updated analysis confirms containment survivability during a hydrogen burn event

Westinghouse

Flux Doubling Compliance with IEEE-603

Problem Statement:

- The design did not comply with a portion of IEEE 603 Sub-clause 6.6 criteria:
  - Whenever the applicable permissive conditions are not met, a safety system shall automatically prevent the activation of an operating bypass or initiate the appropriate safety function(s).

Issue Resolution:

- A new permissive, P-8, based on minimum required reactor coolant temperature for criticality (MTC), was added
- Design now complies with IEEE-603

Westinghouse

Main Control Room Heat Up

Problem Statement:

- Throughout the design evolution of the MCR, the size and quantity of equipment have increased, raising the total MCR heat load. These increases result in a MCR temperature response exceeding the current licensing basis limit and equipment qualification conditions
- A new more limiting transient where non-safety power is provided to non-safety equipment but VBS is NOT available was identified

Main Control Room Heat Up

Issue Resolution

- Two stage automatic load shed
  - This automatic operation is proposed to maintain the required MCR environmental conditions
    - Only select non-safety loads are de-energized, with no impact to the minimum inventory of displays / controls provided by the primary dedicated safety panel
    - No impact to the plant controls and indication of plant parameters at operator workstations
    - Load shed circuitry is safety related

- Additional Surveillance Requirements
  - Limit initial conditions for adjacent rooms in the updated MCR Heat Up analysis
  - Limit moisture content for air in the VES storage tanks

- Human Factors Considerations
  - Analysis supports unlimited operator stay time at a WBGT Index of 90°F
    - Acceptance criterion is from NUREG-0700
    - Same limit is met for post-72 hour ancillary fan operation

- Evaluation concludes that proposed changes confirm MCR temperature requirements are met and no limits are imposed on personnel stay time

Westinghouse

DUKE ENERGY®

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Presentation to the ACRS Full Committee

Staff Review of AP1000 Design Changes and Departures in the Levy Nuclear Plant Combined License Application

Overview

April 7, 2016

Overview – Levy COL

- Levy COL staff interaction with ACRS 2011
  - Letter of conclusion and recommendations

- 2012-2016 staff review of additional applicant submittals
  - Key chapters of advanced safety evaluation issued or re-issued

Topic	Advanced SE	ARCS Meeting
AP1000 Departures	Chapter 21	April 2016
Condensate return design change	Section 6.3 (Chapter 21)	September 2014
Fukushima recommendations	Chapter 20	January 2013
Bulletin 2012-01	Chapter 8	Not planned
Emergency preparedness enhancements	Chapter 13	Not planned

Overview– Levy Departures

- DEF identified 6 departures that require review prior to Commission decision on issuing COL

- Addressed in separate Chapter 21
  - 21.1. Condensate return (2 departures)
  - 21.2. MCR Dose
  - 21.3. MCR Habitability (Heatup)
  - 21.4. Combustible Gas Control in Containment (Hydrogen Vent ITAAC)
  - 21.5. Source Range Flux Doubling Logic for Boron Dilution Operating Bypass (IEEE 603-1991)

Staff Presenters

- Condensate Return
  - Boyce Travis - Containment and Ventilation
  - Tim Drzewiecki – Reactor Systems, Nuclear Performance & Code Review

- Main Control Room Dose
  - Michelle Hart - Accident Consequences

- Main Control Room Heatup
  - Boyce Travis - Containment and Ventilation

- Hydrogen Vent ITAAC
  - Anne-Marie Grady - Containment and Ventilation
  - Robert Roche-Rivera – Structural Engineering Branch

- Flux Doubling Logic Operating Bypass
  - Jack Zhao - Instrumentation and Control

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Presentation to the ACRS Full Committee

Staff Review of AP1000 Design Changes and Departures in the Levy Nuclear Plant Combined License Application

Passive Core Cooling System Condensate Return

April 7, 2016

Licensing Impact

- Design change includes exemption request and two departures from AP1000 DCD Revision 19
  - Departure 3.2-1
    - Modifications to the polar crane girder, internal stiffener, and passive core cooling system (PXS) gutters
  - Departure 6.3-1
    - Changes DCD PRHR-HX capability to maintain safe shutdown for non-LOCA events from “indefinitely” to 14 days (72-hour safety-related mission time)

- Levy FSAR/DCD chapter and section changes
  - 3.2, 3.8, 5.4, 6.3, 7.4, 9.5, 14.3, 15, 15.2.6, 19, 19E and technical specification bases (Chapter 16)

Staff Findings—Containment Impact

- Containment peak pressure unchanged, due to conservatisms (as compared to minimizing condensate return) inherent in analysis
- Potential lowered IRWST level following PRHR HX actuation does not challenge actuation of ADS 1/2/3
- Containment floodup level (in the event of containment recirculation) following actuation of ADS stage 4 or LOCA not adversely affected
- Calculated condensation return rate of approx. 80% in the long term based on testing and analysis is acceptable
  - This value is roughly the fraction of condensate returning to the IRWST that reached the containment shell
  - In the early stages of the transient, the return rate is significantly lower, and this is captured in the applicant's analysis

Staff Findings— Passive Core Cooling System

- Chapter 15 analyses are not affected
  - Bounding analysis described in FSAR Section 6.3.3.2.1.1
  - Analysis demonstrates non-LOCA Chapter 15 acceptance criteria for satisfied for at least 72 hours

- Condensate return rate is sufficient to meet cooldown requirement of reaching 420 ˚F in 36 hours

- Transition to open loop cooling is retained as backup to PRHR HX

Additional Considerations

- Ambient Heat Loss
  - Updated FSAR, Section 5.4.5.2.1, to include maximum heat transfer rate specification for metallic reflective insulation
  - Update criteria to actuate ADS
  - Staff findings
    - No adverse impact on Chapter 15 DBA analyses
    - No adverse impact on safe shutdown analysis
    - ADS actuation criteria established diverse and reliable indication of adequate core cooling

- ADS equipment qualification
  - Staff found reasonable assurance that open loop cooling can be established during an extended station blackout event

Conclusions

- Staff findings from Sept. 2014 safety evaluation unchanged
  - Chapter 15 not impacted
  - Passive core cooling system is capable of cooling the RCS to 420 °F in 36 hours
- Consideration of ambient heat losses does not adversely impact Chapter 15 analyses
- Loss of subcooling expected to occur within 14 days
  - PRHR HX does not degrade
    - Analysis
    - Test data
- Transition to open loop cooling is retained as backup to PRHR HX

Presentation to the ACRS Full Committee

Staff Review of AP1000 Design Changes and Departures in the Levy Nuclear Plant Combined License Application

Main Control Room Dose

April 7, 2016

MCR Dose Departure Overview

- DCD MCR dose analyses did not explicitly include direct radiation from VES filter and other discrepancies required analysis updates

- Design changes include exemption request and site-specific departure from AP1000 DCD Rev. 19
  - LNP DEP 6.4-1
    - Revise DBA dose analyses
    - Add VES filter shielding and related ITAAC
    - Reduce TS allowable secondary coolant iodine activity concentration
    - Revise radiation monitor setpoints
    - Change the VES actuation signal name from “high-high” to “High-2”

Staff Review

- Changes to DBA dose analysis
  - Direct dose from VES filter
  - Shielding provided for VES filter
  - Shielding analysis methods used by applicant
  - Additional analysis changes made to increase analysis margin, update methods or incorporate updated detailed design information
    - Some changes affected offsite dose also

- Review methods used by the staff
  - Scoping calculations
  - Audit of applicant MCR envelope design packages
  - Audit of applicant DBA dose analysis packages
  - Audit of applicant MCNP shielding input/output files

Review Results

- Proposed changes are acceptable because they either use methods that were previously found acceptable in review of the DCD or use methods that are in conformance with NRC guidance, use updated detailed design information, and/or reflect the proposed site-specific changes to the design

- Margin in calculated MCR total dose for all DBAs ensures compliance with GDC 19 for use of safety-related VES

- Revised DBA dose analyses show that the estimated offsite doses meet the applicable dose criteria

Conclusion

- Staff has reasonable assurance that the proposed MCR dose analysis departure from the AP1000 certification rule at the Levy Units 1 and 2 site meets the following requirements:
  - 10 CFR 52.79(a)(1) dose guidelines and the dose acceptance criteria in SRP 15.0.3 with respect to the offsite radiological consequences of DBAs
  - GDC 19 control room habitability dose criterion for operation of the VES under High-2 radiological conditions for all DBAs

Presentation to the ACRS Full Committee

Staff Review of AP1000 Design Changes and Departures in the Levy Nuclear Plant Combined License Application

Main Control Room Habitability (Heatup)

April 7, 2016

MCR Temperature and Humidity

- Two periods of interest:

  - 0-72 hours (VES in operation)
    - New heat loads reflected in revised GOTHIC analysis
    - MCR substantially lower than 90 WBGT during first 72 hours

  - 3-7 days (ancillary fans in operation)
    - Ancillary fans placed in service to ventilate outside air through MCR
    - Applicant assumed diurnal outside air temperature curve with 101ºF peak and 15 degree day/night difference, with a constant wet bulb temperature of 82.4ºF
    - Staff concluded the analysis demonstrated reasonable assurance that MCR would remain below 90 WBGT for 7 days, even under the worst case outdoor conditions (and substantially lower under any cooler conditions)

Impact on Human Performance

Stage 2 load shed of the Wide Panel Information System

What events must occur to result in VES actuation with off site power available?

- Multiple independent failures and/or beyond design basis event

What indications remain available?

- Shift Manager Office Console
- Senior Reactor Operator Console
- Reactor Operator Consoles (excluding business LAN)

Conclusion

- MCR remains within temperature and humidity limits for human performance and equipment qualification
  - Substantial margin while VES in operation for first 72 hours
  - Remains within limits post-72 hours

- The staff finds the change of acceptance criteria for control room habitability from the effective temperature of 85 F to a WBGT of less than 90 F acceptable. The new limit, based on NUREG-0700 (the established NRC-approved standard for human factors guidance) maintains an unlimited stay time in the control room.

- The staff finds that, given the low probability of events resulting in WPIS load shed and the availability of alternate indications, the WPIS load shed does not undermine the acceptability of the WPIS system

Presentation to the ACRS Full Committee

Staff Review of AP1000 Design Changes and Departures in the Levy Nuclear Plant Combined License Application

Combustible Gas Control in Containment (Hydrogen Vent ITAAC)

April 7, 2016

Licensing Impact

- SECY-93-087 I.J Containment Performance, states that during a severe accident challenge the containment should maintain its integrity.
- Evaluate an exemption request from Tier 1 ITAAC and two corresponding changes from AP1000 DCD, Tier 2, Revision 19
- LNP DEP 6.2-1 proposes to change the acceptance criteria to a specific ITAAC in Tier 1 Table 2.3.9-3, Item 3iii, which specifies a minimum distance from specific hydrogen vents in containment to the containment shell.
- The purpose of the ITAAC is to confirm this distance

Technical Evaluation

- The goal is to keep postulated hydrogen diffusion flame sources away from the containment pressure boundary, to prevent conditions leading to potential failure of the containment shell, hatches, and penetrations.

- A burning hydrogen plume from the passive core cooling system (PXS)-A compartment (Room 11206) to the core makeup tank (CMT)-A (Room 11300) could potentially challenge containment allowable limits

- This is a single low probability initiating event involving multiple failures

Technical Evaluation

- Applicant performed a CFD sensitivity analysis to locate hot spots.
- Applicant performed a one-dimensional (1D) heat transfer analysis, modeling radiation and convection, to calculate temperature distributions on the containment pressure boundary in the area near the lower equipment hatch.
- Maximum temperatures on the containment shell, equipment hatch cover, and the hatch barrel were calculated and averaged for input to the program used for the structural analysis.

Technical Evaluation

	Temperature (° F (° C))	Peak Average Temperature (° F (° C))	Peak Average Temperature (° F (° C))
Component	Hot Spot Allowables	Zone 1=Radiation and Convection	Zone 2=Radiation Only
Containment Shell	607 (319)	442 (228)	411 (210)
Insert Plate/Barrel	390** (199)	308 (153)	293 (145)
Hatch Cover	780 (416)	577 (303)	530 (277)

Allowable maximum temperature limit from ASME Code Service Level C for SA 738 Grade B.

** Allowable maximum temperature limit for insert plate/barrel corresponds to acceptance criterion for ethylene propylene diene monomer (EPDM) rubber

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Structural Evaluation of CV

- Staff focused review of survivability of the CV including equipment hatch to confirm that the containment integrity is not challenged due to hydrogen diffusion flame migrating from the PXS-A compartment.
- Particular emphasis on:
  - Temperature distribution on CV and equipment hatch considering hot spot. The hot spot area is a local area where the burning plume could affect the CV pressure boundary.
  - Peak average wall temperature on the hot spot is 780 ºF
  - Temperature limit of 390 ºF for the equipment hatch seal is based on EPDM rubber manufacturer allowable.
  - The CV and the hatch stresses are within ASME NE-3000 Service Level C. The metal resultant stress of 15.25 ksi from ANSYS analysis vs ASME allowable of 63.6 ksi at 800 ºF.
  - Metal creep is not significant factor for short duration
- Staff concluded that the applicant analysis meets the ASME requirements and the containment integrity is not challenged.

Conclusions

- Staff concludes that the methodology and assumptions in the analysis for determining the temperature source terms from the hydrogen burns are appropriately conservative, and the results are acceptable to be used as input to the structural analysis
- Based on the staff's evaluation of containment survivability, the staff finds that containment integrity is not challenged due to diffusion flame hydrogen burn from the CMT-A room in the containment.

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Presentation to the ACRS Full Committee

Staff Review of AP1000 Design Changes and Departures in the Levy Nuclear Plant Combined License Application

Source Range Flux Doubling Logic for Boron Dilution Operating Bypass (IEEE 603-1991)

April 7, 2016

Regulatory Requirements

- Clause 6.6 in IEEE Std. 603-1991, which is incorporated by reference in 10 CFR Part 50.55a(h), includes the following requirements on operating bypasses for safety functions:

  - Whenever applicable permissive conditions are not met, a safety system shall automatically prevent activation of an operating bypass of a safety function

    or

  - Initiate the appropriate safety function(s).

Proposed Design Change

- In current design, operators can block the source range flux doubling logic input to the boron dilution block at any time, and there is no permissive condition implemented in the PMS to permit bypassing of source range flux doubling logic for boron dilution block during startup.

- Proposed major changes include a new permissive, P-8, to permit bypassing the flux doubling logic safety function, add logic in PMS to force chemical and volume control (CVS) demi. water system (DWS) isolation valves **closed** if the flux doubling logic is bypassed while RCS temp. < P-8, and add a reset of flux doubling logic when RCS temperature falls below P-8.

Conclusion

The staff concludes that the proposed changes to the PMS design for bypassing the source range neutron flux doubling logic input to the boron dilution block comply with criteria in Clause 6.6 of IEEE 603-1991, “Operating Bypasses.”

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Acronyms and Definitions

- ADS – Automatic Depressurization System
- CFD – Computational Fluid Dynamics
- CMT – Core Makeup Tank
- COL – Combined License
- CV – Containment Vessel
- CVS – Chemical and Volume Control System
- DBA – Design Basis Accident
- DWS– Demineralized Water System
- EPDM – Ethylene Propylene Diene Monomer
- GDC – General Design Criterion
- IEEE – Institute of Electrical and Electronics Engineers
- IRWST – In Containment Refueling Water Storage Tank
- ITAAC – Inspections, Tests, Analyses and Acceptance Criteria
- MCNP – Monte Carlo N-Particle
- MCR – Main Control Room
- PMS – Protection and Safety Monitoring System
- PRHR HX – Passive Residual Heat Removal Heat Exchanger
- PXS – Passive Core Cooling System
- RCS – Reactor Coolant System
- TS – Technical Specification
- VES – Main Control Room Emergency Habitability System
- WBGT – Wet Bulb Globe Temperature
- WPIS – Wide Panel Information System

Industry Perspective on Draft RG 1.229

Stephen Geier

Senior Project Manager, Nuclear Energy Institute

ACRS Full Committee

APRIL 7, 2016

Rockville, MD

NEI Perspective

- As part of the 50.46c rulemaking, guidance provides needed flexibility in use of risk-informed approach to address effects of debris on post accident long-term core cooling
- Assists in resolution of open issues affecting PWRs and BWRs

Industry Perspective on Draft RG 1.229

Wayne Harrison

STPEGS Licensing Lead – GSI-191 Risk Informed Approach

RISK-INFORMED APPROACH FOR ADDRESSING THE EFFECTS OF DEBRIS ON POSTACCIDENT LONG-TERM CORE COOLING

APRIL 7, 2016
Rockville, MD

Industry Perspective on Draft RG 1.229

- Draft RG 1.229 should be issued with 10CFR50.46c rule change package
- Consistent with goal of issuing guidance along with rules
- Provides definition of content needed for risk-informed application
- Guidance is consistent with the review of the STP pilot application

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Regulatory Guide 1.229
Risk-Informed Approach for Addressing the Effects of Debris on Post-Accident Long-Term Core Cooling

Advisory Committee on Reactor Safeguards
April 7, 2016

Steve Laur, CJ Fong
Division of Risk Assessment
Steve Smith, Division of Safety Systems
Office of Nuclear Reactor Regulation

Key Messages

1. Staff requests a letter based on:
   - Commission policy on Cumulative Effects of Regulations (CER)
   - Licensee schedules
2. Technical issues have been discussed and RG is ready for use (industry agrees)

Reason 1 for publishing RG 1.229 now

Commission Policy on CER:

“The staff should publish draft guidance with proposed rules and publish final guidance with the final rule.”

(SRM-SECY-11-0032)

Reason 2 for publishing RG 1.229 now

Publishing RG 1.229 now will facilitate reviews and will add clarity and stability to the licensing process.

- First non-pilot “Option 2” plant expected September 2016
- Eight more submittals expected in 2017

Future revisions to RG

- Staff currently developing more realistic LOCA frequency allocation methods
  - NRR, RES senior management met on 2/8/16; agreed to augment Appendix C with more realistic methods
  - Project plan has been developed
  - Key RES and NRR staff identified
  - Target completion: late 2016 / early 2017
- These and other lessons will be incorporated into Revision 1

Path forward for RG 1.229

- RG 1.229 is ready for use now
  - Internal NRC concurrence has been achieved
  - Industry agrees
- Bounding method (Appendix C): suitable for STP pilot based on staff confirmatory calculations
- Staff will evaluate experience and use lessons to revise RG 1.229 if needed

Industry Perspective on Spent Fuel Retrievability and Dry Cask Storage License Renewal

Kristopher Cummings
Nuclear Energy Institute
Advisory Committee on Reactor Safeguards
April 7th, 2016 • Rockville, MD

Spent Fuel Retrievability

- Dry storage cask technologies have been designed to prevent/limit degradation or damage to fuel during storage:
  - Inert environment (i.e., helium)
  - Limited/no residual water via established drying process
  - Basket/canister design prevent significant fuel movement
  - Limitation of the peak clad temp below 400°C (realistically much lower)
  - Natural events fail to cause significant stresses on the fuel
  - Confinement boundary prevents water ingress
- Technologies exist today to handle fuel with gross ruptures or structural defects without impact on worker or public safety.
- A revised performance-based and risk-informed definition for "canister-based" retrievability is a good application of a risk-informed framework.

Cornerstones for Effective Dry Storage License Renewal and Extended Storage Timeframes

- Consistent format and content of license renewal applications (LRAs)
- Operations-based aging management through learning aging management programs
- Sharing of operating experience related to aging management - AMID
- Periodic "tollgate" safety assessments

LRA Format and Content

- Section 1: General Information
- Section 2: Scoping Evaluation
- Section 3: Aging Management Review
- Section 4: Time Limited Aging Analysis (TLAAs)
- App. A: Aging Management Programs
- App. B: Granted Exemptions
- App. C: License/CoC Changes
- App. D: UFSAR Supplement
- Additional appendices as needed (environmental report supplement, financial qualification, etc.)

Operations Based Aging-Management

- Key concept:

  Effective licensee implementation of an operations-based DCS aging management program will require the ability to efficiently change AMAs based on feedback from operating experience, research, monitoring, and inspections

- Achieved through:
  - Current Licensee Inspection & Maintenance Programs
  - “Learning” Aging Management Programs
  - NRC Inspection Programs
  - Reliable and Trusted 72.48 Change Control Process

ISFSI Aging Management INPO Database

- Cask vendors (AREVA-TN, Energy Solutions, Holtec, NAC) have, in collaboration with INPO, agreed to develop an information sharing database of aging management OE.
- Guiding Principles:
  - Not a replacement of existing Corrective Action Program
  - Information available to all CoC holders and licensees
  - Use of screening criteria
  - CoC Holder Approval
  - Entry of both positive and negative information

Industry Dry Cask Storage OE Database

Logged In As: Eric Shewbridge

Home OE Database Search Certrec Portal Logout

Modify Print Back

OE Database

ID	2
Added By	Michelle Thomas
Date Added	9/4/2015 2:11 PM
Modified By	Al Haeger
Date Modified	9/9/2015 10:30 AM
Source of Data	AMP Inspection
Originator	EPRI
Date of Data Acquisition	09/09/2015
Data Entry Organization	
Location	Test
ISFSI Environment (Ultimate Heat Sink)	Salt Water
Ambient Temperature at time of Data Acquisition	Degrees F
Ambient Relative Humidity@Time of Data Acquisition	Percent
Dose Rate at Component Surface	mrem/hr
Storage Technology	Test
System Info(Affected Structure, System, Component)	Test
Cask in Service Date	11/01/2013
Heat Load at time of data acquisition	kW
Description of Information, data	Test entry
Material	reinforced concrete
Weld/HAZ Involvement	Neither
Code Applicability	
Inspection/NDE Technique/Instrumentation	

Toll Gates

- Commitment to periodic, documented safety assessments
- Assessment timing specified after renewed operating period begins determined by the specific licensee or CoC holder
- Integrates OE, research, monitoring, and inspection results and assesses aggregate impact (e.g. applies CISCC susceptibility criteria & HBU R&D results)
  - If confirmatory, proceed to next toll gate (no action)
  - If not, pre-plan for possible outcomes – e.g., implement corrective actions, if needed, under licensee's corrective action program
- Piloted in Calvert Cliffs and Prairie Island renewals tailored for specific issues – Canister corrosion, high burnup fuel

Summary

- Efficient dry storage licensing processes are essential for effective management of the growing and aging dry storage cask population.
- Success in applying a risk-informed framework has shown progress in several focused areas:
  - Defining retrievability on a canister/cask basis
  - More efficient and flexible license renewal process (NEI 14-03 and NUREG-1927, Revision 1)
- Additional progress can be made on applying a risk-informed framework to CoC/license content.

Thank you

Questions?

Abbreviations

- AMA – Aging Management Activity
- AMP – Aging Management Program
- CAP – Corrective Action Program
- CISCC – Chloride-Induced Stress Corrosion Cracking
- CoC – Certificate of Compliance
- DCS – Dry Cask Storage
- HBU R&D – DOE/EPRI Demonstration Project
- OE – Operating Experience
- MAPS – Managing Aging Programs for Storage
- PRA – Probabilistic Risk Analysis
- TLAA – Time-Limited Aging Analysis
- LRA – License Renewal Application

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Interim Staff Guidance-2, Revision 2, "Fuel Retrievability in Spent Fuel Storage Applications"

Emma Wong

Division of Spent Fuel Management

Meeting with Advisory Committee on Reactor Safeguards
Framework for Storage and Transportation of Spent Fuel
April 7, 2016

NMSS Division of Spent Fuel Management

Applicable Regulations

- 10 CFR 72.122(l) - Retrievability

  "Storage systems must be designed to allow ready retrieval of spent fuel, high level radioactive waste, and reactor-related GTCC waste for further processing or disposal"

- Applies to general and specific licensed ISFSIs

Applicable Regulations(con't)

- 10 CFR 72.236(m)

  "To the extent practicable in the design of storage casks, consideration should be given to compatibility with removal of the stored spent fuel from the reactor site, transportation, and ultimate disposition by the Department of Energy."

- Applies to storage CoCs

Interim Staff Guidance-2

- Previous revision 0
  - Guidance to meet retrievability without needing to handle individual fuel assemblies
- Current revision 1
  - Ability to move a canister to a transportation package or a location where the spent fuel can be removed and
  - Ability to handle individual spent fuel assemblies by normal means

Interactions

- Public meetings
  - July 2011, August 2012, July and October 2015
- Public comments received
  - 2013, 2015
- ACRS subcommittee meeting
  - March 23, 2016
- ACRS full committee meeting
  - April 7, 2016

Draft Revision 2

- Focuses on safety and design bases to allow maximum flexibility to maintain safety for an undefined storage duration
- Continue to protect public health and safety
- Ensure spent fuel can be retrieved from storage safely for further processing or disposal
- Provide guidance to the NRC staff on licensing reviews

Ready Retrieval

The ability to safely remove the spent fuel from storage for further processing or disposal.

Ability to do one or a combination of the following:

A. remove individual or canned spent fuel assemblies from wet or dry storage,
B. remove a canister loaded with spent fuel assemblies from a storage cask/overpack,
C. remove a cask loaded with spent fuel assemblies from the storage location.

Questions/Comments

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Contact:

Emma Wong: (301) 415-7091

emma.wong@nrc.gov

Division of Spent Fuel Management
NMSS

References

- 42 U.S. Code §10101 et seq. Nuclear Waste Policy Act (NWPA) of 1982, as amended.
- 53 FR 31651; 1988. Final Rulemaking "Licensing Requirements for the Independent Spent Fuel Storage of Spent Nuclear Fuel and High-Level Radioactive Waste."
- 78 FR 3853; July 17, 2013. "Retrievability, Cladding Integrity and Safe Handling of Spent Fuel at an Independent Spent Fuel Storage Installation and During Transportation."
- COMSECY-10-0007 "Project Plan for the Regulatory Program Review to Support Extended Storage and Transportation of Spent Nuclear Fuel," ML101390216.
- Draft ISG-2, Revision 2, "Fuel Retrievability in Spent Fuel Storage Applications," ML15239A695.
- Final draft ISG-2, Revision 2, "Fuel Retrievability in Spent Fuel Storage Applications," ML16019A128.
- FRN requesting public comment (78 FR 3853) & comments, ML15110A370.
- ISG-2, Revision 1, "Fuel Retrievability," ML100550861.
- ISG-2, Revision 0, "Fuel Retrievability"

References

- NUREG-1536, Revision 1, “Standard Review Plan for Spent Fuel Dry Cask Storage Systems at a General Facility,” ML091060180.
- NUREG-1567, Revision 0, “Standard Review Plan for Spent Fuel Dry Storage Facilities,” ML003686776.
- NUREG-1927, Revision 0, “Standard Review Plan for Renewal of Specific Licenses and Certificates of Compliance for Dry Storage of Spent Nuclear Fuel,” ML111020115.
- NUREG/CR-7198, “Mechanical Fatigue Testing of High-Burnup Fuel for Transportation Applications,” ML15139A389.
- Response to Stakeholder Comments on the Final Draft of ISG-2, Rev. 2, ML16019A134.
- SECY-01-0076, “Retrievability of Spent Fuel from Dry Storage Casks.”
- Summary of Public Meeting on July 27, 2011: “Enhancements to Licensing and Inspection Programs,” ML113000303.

References

- Summary of Public Meeting on August 16, 2012: “Meeting to Obtain Stakeholder Feedback on Enhancements to the Licensing and Inspection Programs for Spent Fuel Storage and Transportation,” ML12261A069.
- Summary of Public Meeting on July 29, 2015: “Public Meeting on Retrievability of Spent Fuel at an Independent Spent Fuel Installation,” ML15216A272.
- Summary of Public Meeting on October 29, 2015: “Public Meeting on the Draft Interim Staff Guidance (ISG) 2, Revision 2: Fuel Retrievability Under 10 CFR Part 72,” ML15317A259.

Abbreviations

- ACRS – Advisory Committee on Reactor Safeguards
- CFR – Code of Federal Regulations
- CoC – Certificate of Compliance
- GTCC – Greater than Class C
- ISFSI – Independent Spent Fuel Storage Installation
- ISG – Interim Staff Guidance

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Proposed Final NUREG-1927, Rev. 1

Standard Review Plan for Renewal of Specific Licenses and Certificates of Compliance for Dry Storage of Spent Nuclear Fuel

Kristina Banovac, Aladar Csontos, Darrell Dunn, Ricardo Torres, John Wise

Office of Nuclear Material Safety and Safeguards
Division of Spent Fuel Management

Meeting with Advisory Committee on Reactor Safeguards
April 7, 2016

Outline

- Storage renewal requirements and guidance
- Development of NUREG-1927, Rev. 1
- Changes in NUREG-1927, Rev. 1

Storage Renewal Requirements and Guidance

- Renewal of Independent Spent Fuel Storage Installation (ISFSI) specific licenses and Certificates of Compliance (CoCs) for dry storage system designs, for a period not to exceed 40 years
- Maintain intended functions in the period of extended operation (PEO)
  - Time-limited aging analyses (TLAAs)
  - Aging management programs (AMPs)
- NUREG-1927, Rev. 0 issued in March 2011

NUREG-1927, Rev. 0 → Rev. 1

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- NRC staff experience with storage renewal reviews indicated a need for expanded guidance
- NUREG-1927 revision identified as a high-priority
- Valuable input received from stakeholders at over 20 NRC-sponsored public meetings, including:
  - Public meetings specific to NUREG-1927 (July 2014, July 2015)
  - ACRS Subcommittee on Metallurgy & Reactor Fuels (April 2015, March 2016)
- Draft Rev. 1 published for public comment in July 2015
- Staff developed responses to public comments and the proposed final Rev. 1 for ACRS coordination

NUREG-1927, Rev. 1 Structure

- Front Matter (Abstract, Abbreviations, Introduction)
- Chapter 1: General Information Review
- Chapter 2: Scoping Evaluation
- Chapter 3: Aging Management Review
- Chapter 4: Consolidated References
- Chapter 5: Glossary
- Appendices:
  - A – Non-Quantifiable Terms
  - B – Examples of AMPs
  - C – Reserved
  - D – Use of Demonstration Program as a Surveillance Tool for Confirmation of High Burnup Fuel Integrity During PEO
  - E – Considerations for CoC Renewals
  - F – Storage Terms

Changes in NUREG-1927, Rev. 1

- Updates and clarifications made throughout NUREG-1927, Rev. 1
- Changes in NUREG-1927, Rev. 1 are highlighted on the following slides

Chapter 1:
General Information Review

- Expanded guidance on application content
- Added guidance on timely renewal
- Added guidance for aging management considerations in amendment applications submitted during renewal reviews or after the renewal is issued
- Added guidance on terms, conditions, or specifications that may be added to specific licenses and CoCs as part of the renewal

Chapter 2: Scoping Evaluation

- Expanded guidance for:
  - Sources of information that may be used to support the scoping evaluation
  - Review of structure, system, and component (SSC) subcomponents
  - Scoping of fuel assemblies
  - Scoping of certain SSCs depending on whether they are considered to be part of the design bases for a particular license or CoC
  - Ensuring exclusions from the scope of renewal are justified

Chapter 3: Aging Management Review

- Expanded guidance on environmental data and identification of aging mechanisms and effects
- Expanded guidance on aging management review for fuel assemblies
- Expanded TLAA guidance
- Expanded discussion on each of ten AMP elements
- Added guidance on learning AMPs
- Added discussion of specific NEI 14-03 concepts
  - Periodic assessments of operating experience in the PEO
  - Aggregation and dissemination of operating experience

Chapter 3: Aging Management Review (cont.)

- Added guidance on how pre-application inspection results support the aging management review
- Consolidated guidance discussion on retrievability
- Added guidance on commencement of AMPs for CoC renewals
- Added guidance on implementation of AMPs for licenses/CoCs in timely renewal

Appendix B: Example AMPs

- Deleted previous appendix and replaced with example AMPs:
  - Localized Corrosion and Stress Corrosion Cracking of Welded Stainless Steel Dry Storage Canisters
  - Reinforced Concrete Structures
  - High-Burnup Fuel Monitoring and Assessment Program
- Based on consensus codes and standards where practicable
- Use achievable and actionable acceptance criteria
- Rely on licensee quality assurance and corrective action programs to maintain the SSC intended functions in the PEO

Path Forward

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- Receive ACRS letter (if needed) – April 2016
- Publish final NUREG-1927, Rev. 1 – Summer 2016

References

- 10 CFR Part 72, http://www.nrc.gov/reading-rm/doc-collections/cfr/part072/
- NUREG-1927, Rev. 0, http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1927/r0/
- Draft NUREG-1927, Rev. 1, http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1927/r1/
- FRN issuing Draft NUREG-1927, Rev. 1 for public comment, http://www.gpo.gov/fdsys/pkg/FR-2015-07-07/pdf/2015-16540.pdf
- Proposed Final NUREG-1927, Rev. 1 and comment responses (for ACRS coordination), ADAMS Accession No. ML16053A199
- NEI 14-03, Rev. 1, ADAMS Accession No. ML15272A329

Acronyms

- ACRS: Advisory Committee on Reactor Safeguards
- AMP: Aging Management Program
- CoC: Certificate of Compliance
- ISFSI: Independent Spent Fuel Storage Installation
- NEI: Nuclear Energy Institute
- PEO: Period of Extended Operation
- SSC: Structure, System and Component
- TLAA: Time-Limited Aging Analysis