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MEETING WITH THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

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TRANSCRIPT OF PROCEEDINGS

Public Meeting

Before the U.S. Nuclear Regulatory Commission:

Gregory B. Jaczko, Chairman

Kristine L. Svinicki, Commissioner

George Apostolakis, Commissioner

William D. Magwood, IV, Commissioner

William C. Ostendorff, Commissioner

APPEARANCES

ACRS Members:

Said Abdel-Khalik
Chairman

John W. Stetkar

Harold B. Ray

Michael T. Ryan

Dennis C. Bley

P R O C E E D I N G S

CHAIRMAN JACZKO: Good morning everyone. The Commission meets today to hear from the members of the Advisory Committee on Reactor Safeguards. I'd like to begin by thanking the members of ACRS for their tremendous work over the past few months. The ACRS has experienced a very high workload and to their credit, processed it in a timely and thorough manner that they are known for.

You may, or may not, be pleased to hear that it appears that your workload may hopefully stabilize and perhaps slow down a bit over the next couple months as a lot of important work comes to completion. But as we all know, there are many important issues that the agency will be addressing over the coming years. The ACRS will have a very important role as the Japan Task Force completes its work and the Commission considers the long term implications of the events in Japan for domestic nuclear safety. As a result, there will probably be little rest for the weary on either side of this table. But during today's meeting, we'll have an opportunity to discuss several important issues, in addition to hearing briefly about issues related to Japan. We'll be hearing about fire protection, small module reactors, the fuel cycle oversight process and the AP1000 reactor design certification.

As always, we have benefitted from the ACRS's independent expert perspective on these important questions. So with that, I offer my colleagues an opportunity to make any opening remarks if they'd like to. Well, I'll

turn it over to you, Dr. Khalik, if you'd like to start.

DR. KHALIK: Thank you. Before I start, I'd like to point out that several ACRS members are not in attendance today because of the unusual time in which this meeting has been scheduled, namely ahead of, rather than during the full committee meeting. So there is no message being sent here, we all appreciate the opportunity to meet with you today. Next slide.

I'd like to begin by offering a brief summary of our current and planned activities in response to the events at Fukushima. In a nutshell, we are gathering information from all stakeholders so that we can understand the details of the event; distill the lessons learned, and ultimately, make recommendations for appropriate follow-up actions by NRC in order to enhance the safety of the American public. To that end, we have formed a sub-committee of the whole to address all Fukushima related issues. Next slide.

We have received briefings from the NRC staff and other stakeholders and plan to hold additional sub-committee meetings. An overview of the event was provided to us by the staff on April 7. We have also been briefed by both DOE and NEI on May 26, 2011. We expect to be briefed by Mr. Virgilio, the Deputy EDO at the next sub-committee meeting on June 23, and have arranged for INPO to brief us on July 12.

As you are all well aware, we have been tasked to evaluate the staff's longer term review and we expect to report back to you as requested before the end of February. It is our intent to also review the near term report to be prepared by the task force in July. And it is our hope that the task force will facilitate that review. In addition to reviewing these two staff reports, we may issue additional reports as warranted based on interactions with all stakeholders.

Next slide.

At this time, I'd like to move on to our other activities. Since our last meeting on November 5, we have issued 32 reports on a wide range of topics. Today my colleagues will brief you on four of these topics, transition to NFPA 805, comparison between ISA and PRA for Fuel Cycle Facilities, use of risk insights to enhance the safety focus of small modular reactor reviews, and the design certification amendment and COLA reviews of the AP1000. Next slide. Next slide. Slide seven please.

We have also reported on a wide range of other topics as listed on the next five slides: containment accident pressure in analyzing the use of containment accident pressure in analyzing ECCS performance in postulated accidents, emergency planning rule, safety culture policy statement, and standards review plan for renewal of dry cask storage licenses and certificates of compliance. Next slide.

Other topics of note on which we reported include: revisions to the generic license renewal documents, the license renewal for Palo Verde, Kewaunee, and Salem, and the extended power upright for Point beach. Next slide.

The list goes on. We have also reported on the advanced reactor research plan, human factors considerations associated with emerging technologies and the efforts of the groundwater protection task force. Next slide.

Finally, as listed on the next two slides, we have reviewed several regulatory guides on a wide range of topics from welding of low alloy steel to the use of computers in safety systems. Next slide. Next slide please, slide 12.

At this point, I'd like to move on to ongoing activities. In the area of

new plants, ongoing activities include review of the design certification applications and associated safety evaluation reports for the US EPR and the US APWR, long term cooling for the ABWR, the reference COLAs for the ABWR, ESBWR, U.S. APWR, and U.S.EPR and subsequent COLAs for AP1000. The point to be made here is that we continue to complete all our reviews promptly, as the documentation becomes available. Next slide.

In the area of license renewal, our license renewal subcommittee has performed interim reviews of Diablo Canyon and Crystal River and will perform interim reviews of Seabrook and Columbia later this year. Next slide.

In the area of power upgrades, we will review EPU applications for Turkey Point, Nine Mile Point, Grand Gulf, and Monticello as the staff completes their safety evaluations. Later this week, we will review a topical report on the applicability of GE methods to extended operating domains for BWRs. Next slide.

Finally, this is a partial list of ongoing and future activities including 50.46b, SMRs, 10 CFR 61 and the construction reactor oversight process in addition, of course, to Fukushima.

Let me conclude by saying that we continue to work on all cylinders. Yet we continue to meet our commitments by providing thorough and timely reviews of technical matters, important to the mission of this agency, protecting the health and safety of the American public and the environment. Thank you, that concludes my presentation. I'd like to call on my colleague, John Stetkar.

MR. STETKAR: Thank you Said. First slide please. I'm going to try to give you a brief overview of our work regarding transition to NFPA 805.

This is quite a complex issue and there are a lot of topics to cover, so you'll have to excuse a rather rapid fire presentation here. As you're aware, 10 CFR 50.48c was issued in 2004 and it allows licensees to adopt and maintain a risk informed performance based fire protection program that meets the requirements of NFPA standard 805, as an alternative to deterministic requirements in 10 CFR 50.48b or the plant specific fire protection license conditions. Next slide.

June 25, 2010, a Staff Requirement's Memorandum was issued to the ACRS which requested that we should conduct a review and report back to the Commission on the current state of licensee efforts to transition to NFPA Standard 805. In particular, the review should include methodological and other issues that may be impeding the transition process, lessons learned from the pilot projects and recommendations to address any issues identified. Next slide.

And the review should determine whether the level of conservatism of the methodology is appropriate and whether any adjustments should be considered. Next slide.

As a context, you're aware that two pilot plants -- two plants were selected to pilot the transition process: Oconee and Shearon Harris. Shearon Harris safety evaluation report was issued in June 2010. The Oconee safety evaluation was issued in December 2010. Of note for Oconee is that the issuance of that safety evaluation started a time clock for -- a six month time clock for other applicants who have expressed a desire to transition to NFPA 805. We are now nearing the end of that nominal time clock. Next slide please.

Regarding our review of this transition process, we initiated several efforts. One effort involved a consultant we hired, Marty Kazarians who went out and interviewed industry practitioners and NRC staff to try to gain information

and insights from people who are actually performing the work and reviewing the work. It's a little bit different insight than you might gain through a public meeting. Our reliability and PRA sub-committee met twice on the issue in November and December of last year. The full committee completed their review in February and we issued our report on February 17. Next slide please.

I'd like to go through a few of the conclusions and recommendations from our report. First of all, a conclusion is that the guidance in NUREG CR-6850, EPRI 1011989, provides a sound technical basis for the development of fire PRA models and analyses to support the transition. Focused departures from that guidance will be necessary to address some plant specific issues, that's happened already; it will continue to happen. The staff has accepted those departures during the pilot plant reviews, provided that they have adequate technical justification and basis. Next slide please.

The PRA that's developed to support the transition is something that I'll call a baseline PRA. It includes typically simplified models and bounding values that are used for screening specific fire hazards and locations with more fully developed, best estimate models and numerical values for refinements of those initial analyses. This baseline fire PRA supports the staff's determination of assurance that overall safety will be maintained under the risk informed framework; however, the baseline PRA may retain conservative simplifications and assumptions. Next slide.

After a plant has made the transition and it's been approved by this staff, that PRA will then be used to support risk informed licensing applications. Excessive conservatism in those PRA models may affect the quality of decisions that are made during those post-transition applications, so conservatism in the

PRA is important for post-transition use of the PRA, less so for the PRA to support the transition. Conservatisms are especially important for licensee self-approved changes, which are allowed under the framework, provided that the change introduces a minimal increase in risk. Because of this, further refinements of the models in data are needed for more realistic estimates of absolute risk and its relative contributors going forward after the transition. Next slide please.

We specifically were requested to examine sources of conservatism in the PRAs that are being developed for the transition process. We looked at possible sources of conservatism in the methods themselves and we identified three potential sources that are listed on this slide. One possible source would be arbitrary unilateral decisions and inflexible guidance that just dictate a particular methodology. We found no substantive evidence of that type of guidance.

Many people have indicated that the current methods are characterized as being immature. The methods that are presented in NUREG CR-6850 are based on fire analysis methods that have been evolving since the mid-1980s. In fact, the guidance in NUREG CR-6850 compiles that information and develops substantial enhancements in many cases to the methods. So it's really not appropriate to just generically characterize that guidance as immature. It is indeed developed based on a long history of practice.

The third possible source of conservatism in methods is not really due to the methods themselves; it's due to analysts decisions regarding the plant specific level of refinement that is applied within a particular PRA analysis. These are plant specific decisions, they're governed by a myriad of issues that

are too numerous to discuss in this forum, but it's a real decision. Decisions to retain simplified bounding models will inherently retain a certain degree of conservatism in those analysis. Next slide please.

We also looked at sources of numerical conservatism which is a little bit different than modeling conservatism. One possible source is a systematic bias in the numerical use of parameters. In fact, there is some evidence that this may exist primarily due to the interpretation and application of rather limited available fire test data. It's often been noted that there are very, very large uncertainties in many of these parametric values.

We noted that uncertainties by themselves are not a source of numerical conservatism. If the uncertainly adequately captures our current state of knowledge about a particular parameter, then the mean value is not a conservative value; it is indeed our best estimate for what that parameter is. We may be able to reduce the uncertainly later, but simply large uncertainties are not inherently conservative. Next slide please.

With respect to uncertainties, we noted that uncertainties were not quantified in either of the pilot plant PRAs nor are they currently being quantified in any of the in progress, what I'd characterize as "mature" PRAs that were discussed during our subcommittee meetings. We recommend that uncertainties should be quantified consistently with currently accepted methods and guidance. We believe that the quantification and display of uncertainties would enhance our understanding of the perceived numerical conservatisms in these results, and sources of that perceived conservatism and a full display of the uncertainties would enhance the characterization of the results for post-transition risk informed changes. Next slide please.

Regarding the overall plant risk profile, there has been some emphasis on keeping the results from fire risk assessments separate from the results from internal risks and other contributors. We don't feel that's appropriate. We feel that fire risk results should be fully integrated with the results from internal hazards to provide a better understanding of all the contributors to risk and their relative importance. That being said, when you're using these PRAs to evaluate post-transition changes to the plant, we feel that at the current time, it's appropriate to separately characterize the effects from changes in that risk from fires and from internal events in addition to the integrated effects. We feel that would be appropriate to better understand the context of the proposed change and the information that's available from the underlying PRA analyses. Next slide please.

In our report, we recommended a sequential submittal schedule that follows the industry's recommendations with a target completion of the submittals of June, 2012. So instead of having all of the submittals come in at the end of June of this year, an extension of that schedule allowed over the next 12 months. We believe that this extended schedule would provide the ability for analysts to fully incorporate the lessons learned from the two pilot plant projects, provides time for industry peer reviews and resolution of technical issues that are identified during those reviews. We think that the sequential schedule would provide improved technical quality of subsequent submittals and allow the staff to focus on plant specific technical issues during each of those subsequent reviews rather than repeating generic concerns in each of the re-submittals. Next slide.

With regard to departures from the methods that are presented in NUREG CR-6850, it seems that the industry peer reviews are quite effective in

terms of evaluating the studies and the contributors and the effects from those departures. However the problem is that the schedules are very limited by the number of technically qualified independent experts. There just aren't that many people available to perform a very qualified review. We encourage the active engagement of an industry senior technical review group that's been established to evaluate departures from the methods and their generic applicability across the industry. And we also encourage timely staff communications of their technical positions with regard to issues that might have generic applicability. Next slide please.

EPRI in particular has a very well developed research program with regard to fire issues. Their short term research emphasizes primarily improvements to the fire events database. We encourage that because the use of actual plant operating experience should always be factored into risk assessment. We caution about use of the most recent fire experience over the last eight to 10 years, for example, and how that's integrated with the historical experience from -- that extends back over 20 to 30 years. We recommend that the enhanced database explicitly account for plant to plant variability as a contributor to the uncertainties in the fire event frequencies. We also recommend expedited development of data for what's characterized as complement level fire frequencies compared to the current plant level fire frequencies. It's an important issue. Next slide please.

I'd like to speak a little bit about the topic of electrical cabinet fires. They're typically identified as the most important contribution to fire risk, both in the two pilot studies and in the in-progress studies. The issue is very, very plant specific. The risk is determined by the location specific fire hazards, the

geometry of those fire hazards and targets, specific cables in the area and the functions of those cables in terms of the circuits that they carry. Realistic analyses of fire ignition, growth, detection, and suppression within these configurations are rather complex. I'd say even very complex. Next slide please.

Carrying on in the topic of electrical cabinet fires, NUREG CR-6850 defines one general category of things called electrical cabinets. That approach is retained in all of the near term research activities to compile data and develop better information regarding these fires. We feel that that general category should be subdivided into more distinct functional groups. We think that that subdivision would facilitate improved treatment of the fire ignition frequencies, the potential fire severities and the risk effects from specific plant locations, rather than using kind of a one size fits all approach. Next slide please.

A couple of interesting observations from our investigations. One is that there has been very limited use of fire models for evaluating post-ignition growth severity and propagation to date. That's true for the pilot plants and it remains true at least for the more mature in-progress studies that we were briefed on. Those studies rely primarily on parametric values and rather simplified empirical correlations to develop information about fire growth and suppression. It's a complex topic, one of the reasons, I think, for that is there are relatively limited test data available to support anything more complex. And in many cases, the amount of information that's required to develop a more complex model, regarding specific geometry, ignition sites, combustible material loading within a cabinet, for example, or within a larger fire area, is very resource-intensive to develop. So the amount of work that's required to develop that information is substantial. Next slide.

The final interesting observation -- and this, quite honestly, came as a bit of a surprise initially -- is that, not surprising, is that multiple spurious operations, sometimes characterized as “hot shorts,” are often very important contributions to the fire risk. However, that general topic of the evaluation of multiple spurious operations was not identified as a significant impediment to the NFPA-805 transition process; that was a bit surprising. When we spoke to the analysts, they explained that a comparable effort is required these days to identify the routing of cables, look at the circuits that are contained within those cables, and examine the effects of spurious operations, for both deterministic and probabilistic requirements.

The amount -- given the work that's required to do that -- the incremental amount of work to fold those results into the PRA is relatively small, compared to all of the other tasks involved. So, this in total is a large task, but it's required regardless of which path you go down, the probabilistic or the deterministic path. And with that, I will conclude my presentation.

CHAIRMAN JACZKO: Thank you.

DR. KHALIK: At this time, I'd like to call my colleague Harold Ray.

MR. RAY: Thank you, Said. Thank you for this opportunity to share our experiences with an ongoing project, the transition of an existing certified design to support the first construction of the plant. Next slide. 37.

These five letter reports were issued between December 2010 to February 2011. And as I will discuss in a bit, they include a comment that's a little unusual, saying that the ACRS requests the staff to review with us any changes in commitments which deviate from those described during our review. Normally, we review final product; In this case, that was not possible. And this

provision, therefore, was included in our letters, and we look forward to any additional review that's required. Next slide.

This review was conducted in an 18 month period. And as I've suggested, I think it's a learning experience for all concerned. It was definitely successful, in the Committee's judgment, because both the staff and the applicants were committed to support even responsive interactions with the ACRS. And that commitment was maintained throughout. The reference COLA was initially Bellefonte and was revised to become Vogtle by the design center during our reviews. So that was another difference from what we would think of as the norm.

Initially, we used a parallel review process for the design certification and the reference COLA. And it seemed logical at the time, but we changed to what I'll characterize as a “priority based review.” And what this means that initially, it seemed logical that we would review a reference COLA safety evaluation report chapter at the same time we reviewed the corresponding design certification amendment chapter. But after one of our initial two-day sub-committee meetings in July 2009, when we had 45 separate and distinct presentations in that two day period, we thought it was clear that we needed to change our approach, and I think everyone agreed.

Reviewing an amendment to a certified design is a different thought process than reviewing an initial application. And I think that's one of the things we all need to recognize. You're looking at a change to something that's been certified, on the one hand, or you're looking at it a de novo application, describing a particular topical area, on the other hand. And these two things don't work too well when they're combined in this way.

So we assigned our first priority to review of the design certification and then only reviewed the reference COLA when there was no design certification material available at that point in time for our review. This required a great deal of scheduling flexibility by all concerned, and it was successfully achieved, I believe. Next slide. 39.

The DCA review process, one lesson that we learned also, although I'm not sure how much we can incorporate this lesson; but it's a lesson, nevertheless, is the definition of the changes is vital to an effective ACRS review. And what we mean by this can be illustrated as follows: When submitted in 2008, revision 17 to the design certification contained 590 changes, only 27 of which were classified by the applicant as editorial.

So, each substantive change then affected somewhere between five and 10 text pages, we figured. And the roadmap that correlated these two things, that is all the text changes to the many chapters with the individual changes in design, was 93 pages long. So although an effort had been made to correlate the changes with the text, it was very, very difficult to implement as we proceeded with our review.

The number of changes, as I said, started out at 590 and grew over time. And it continued throughout our review period, which gave us an opportunity at the end, as I'll mention, to reinforce the lesson that I'm focused on here. The chapter-by-chapter review of the text revisions makes the change definition difficult, as I've said. And oftentimes, you're looking at material that has been changed by -- or altered -- the text has been altered by many different design changes.

By contrast, we had a category of changes called “late submitted

changes." During our review process, it was late, anyway. And these were reviewed individually, not on a chapter-by-chapter text basis. And this contrast demonstrated to us, anyway, the benefit of reviewing these changes individually, rather than as hundreds of changes superimposed in the same text. But we recognize the chapter-by-chapter staff reviews, on the one hand, and the ACRS review of individual changes, on the other hand, would be a scheduling nightmare and require a lot more time. So it may be that this is a situation for which there isn't any clear and obvious solution. It's just something to be well aware of.

Of course, this is because of staff review of necessity is organized on a chapter-by-chapter basis. And the ACRS review of a change could not occur if we reviewed the changes individually until all the chapters have been reviewed. Next slide, 40.

In addition to this challenge, we had scheduled the parallel DCA and COLA reviews that I mentioned already. And we established priorities for conducting the review with the DCA ahead of the reference COLA. And then that, of course, ahead of the S-COLA. And we were able, in the end, to identify more clearly than otherwise we would have been able to do the changes being made to the certified design.

And I want to again acknowledge the Design Center as having greatly facilitated the management of the reviews during this evolving process. They had to respond to many changes so that we could use our time productively, as it became available, while adhering to priorities that we had established. And of course, also, as I mentioned, the Design Center enabled us to make the transition quite smoothly from Bellefonte to Vogtle.

A consequence of the parallel reviews that was of some concern was that the COLAs required revisions -- do require revisions -- following the ACRS review, to reflect the finalized design certification. And our -- as I mentioned already -- our letters, therefore, already include provisions seeking to have the staff come back to us with any changes or commitments, which deviate from the presentations that were made to us, and we anticipate that that may occur. Next slide, 41.

Conclusions. The ACRS feels that the changes to the certified designs should be presented to the ACRS as individual changes, rather than as revisions to the effected text on a chapter-by-chapter basis. In the case of the AP1000 design certification, with over 500, as I've said a couple of times changes going in, some big, but many small. The effect of doing this on the review schedule is unclear and therefore, we don't want to do more than merely make it as an observation, not as something that we would insist to be done in the future, but take it into consideration.

This is the way, of course, that the applicant develops changes, is change by change, not on a chapter-by-chapter basis. And therefore the logic that we would apply to reviewing the change is much easier to do on that basis.

Finally, the COLAs referencing a certified design should be reviewed after the design certification is completed. That, of course, is the process that was contemplated in Part 52, was not able to be implemented here. And I believe we successfully managed the process. Normally, I think it will naturally be the case that the COLAs will come forward with an established certified design already in place. That completes my conclusions. And turn it back to you.

DR. KHALIK: Thank you, Harold. At this time, I'd like to call on our colleague Mike Ryan.

DR. RYAN: Thank you, Said. Good morning, Mr. Chairman, Commissioners. It's my pleasure to present the Committee's insights to the comparison of the techniques of integrated safety assessment and probabilistic risk assessment for fuel cycle facilities. Next slide, please.

The staff was directed in a May 12, 2010 Staff Requirement Memorandum, to prepare a paper that compares ISAs for fuel cycle facilities to probabilistic risk assessment methods and to seek the ACRS's review. The subsequent SRM from August 4, 2010 stated that it disapproved the staff's plan to develop a revised fuel cycle oversight process and looked forward to the ISA PRA comparison paper and the ACRS letter to better inform the proposed enhancements to the oversight process.

It gave the direction to the staff on how to enhance the oversight process, for example, to offer incentives to maintain a strong, corrective action program, give credit to licensees for maintaining an effective issues identification and resolution program, as examples. Next slide, please.

The earlier letter, in 2002, from the Advisory Committee on Nuclear Waste letter also recommended that the staff enhance their overall understanding of total system risk and to use ISA as a logical path to PRA to enhance treatment of dependencies, to acknowledge the importance of aggregated risk, and to increase quantification and treatment of uncertainties. In the letter -- 2010 ACRS letter -- the Committee also noted that the term “risk” is defined differently within an ISA framework, that is, where scores -- where individual accident sequences are scored rather than evaluated numerically. It's

not consisted with the standard PRA practice that aggregates scenarios into an overall measurement of risk. Next slide, please.

The ACRS noted, during its review of the paper, that ISAs were acceptable for meeting Part 70 requirements. There are important differences between ISAs and PRA methods, and there are advantages to moving the ISA processes systematically in the direction of PRA and in particular PRA insights may be useful in determining the risk significance of inspection findings.

Additional points made in the ACRS letter were that ISAs provide a structured framework for capturing sequences, ISAs may be qualitative or quantitative, ISAs do not provide an overall system risk perspective, and ISAs are used to assure that performance requirements in 10 CFR 70.61b and c are met; namely that the frequency of high consequence events must be highly unlikely that the frequency or intermediate events must be unlikely or the consequences must be reduced so that they are no longer a higher intermediate consequence event. There's little ISA guidance on how to treat common-cause failures, systems interactions, or human actions within the process.

Some key PRA advantages to consider are the use of PRAs within the regulatory processes is well-established. Applicants for certified power plant designs are required to perform and submit a description of their design specific PRA. Operating plant licenses use PRAs to assess safety performance and to enhance plant operation. The NRC uses PRA models to support safety evaluations of operating reactors to the reactor oversight process. PRAs are realistic and they provide relative risk importance of contributors to risk. Relative risk helps in a number of areas, including plant inspections and maintenance activities. Next slide, please.

Some key points to consider are that ISA methods are adequate for simple facilities, while PRA methods have an advantage when applied to complex facilities. For more complex facilities, insights from PRA can be used to risk rank systems, structures, components, and human actions or errors. Risk ranking can be used to provide an integrated perspective to better allocate resources for inspection, monitoring, and maintenance on maintaining items relied on for safety.

The conclusions reached by the ACRS are -- it's in the next slide, please. Got it -- the staff comparison study provided a clear exposition on the advantages and disadvantages of ISA versus PRA. The Committee agrees that ISAs are adequate for licensing fuel cycle facilities under Part 70. The Committee continues to see an advantage in moving the ISA process systematically in the direction of PRA. PRA provides better treatment of dependencies, human error, and uncertainties. And PRA has the ability to risk rank safety systems, components, and can enhance regulatory decision-making. Next slide, please.

The staff should continue to develop and test the use of focused PRA-like analyses to help assess the risk significance of inspection findings at fuel cycle facilities. PRA can help to focus inspections on risk significant areas and PRA also provides a more objective perspective when assessing risk significant findings. Next slide, please.

The Committee continues to support the use of PRA over ISA, especially for complex facilities with high consequences. The Committee plans to continue to interact with the staff on the cornerstones of safety for fuel cycle oversight process and matrices to evaluate performance at fuel cycle facilities.

Thank you very much for your time and attention.

DR. KHALIK: At this time, I'd like to call on our colleague Dennis Bley to present the final presentation.

DR. BLEY: Thank you, Said. I'll be talking about -- I'm recently on small modular reactor reviews. Slide 53, please.

Just as background, I wanted to remind us all of the SRM and the SECY that was written in response to that. Your SRM of August last year directed the staff to integrate risk insights and develop risk-informed licensing review plans for small modular reactors. They had to build on the SMR and NGNP review insights and NUREG-1860, the so-called “technology neutral framework,” to develop a new risk-informed licensing framework for the longer term. And finally, it asked that they identify resolution strategies for policy issues related to SMR licensing described in SECY-10-0034.

In response, with SECY-11-0024, risk insights and SMR reviews, the staff laid out a plan for a risk-informed framework for integrated PWR reviews, for risk-informed design specific review plans, also for each iPWR design, and in the longer term, a new risk-informed regulatory framework. On the next couple of slides, we'll dig into some of the details on the proposed staff approaches. Slide 54.

First, we'll talk about the iPWRs. Staff has developed a risk-informed review framework for near-term iPWR designs. The framework is included in the revised introduction to the SRP. And it's consistent with current regulatory requirements and Commission policy statements. It asks for a graded review, based on safety and risk significance. They also laid out an approach for developing design-specific review plans, tailored for each iPWR design, which is

important to adapt the SRP to examine unique design features of each iPWR and to eliminate aspects of the general SRP that don't apply to those designs. Next slide; 55, I think.

In the longer term, staff proposes a multi-step process for working toward a risk-informed performance based new regulatory framework. The first step of that process is to acquire insights pertinent to iPWR designs by conducting a pilot review of an iPWR design application, applying the principles of the technology-neutral framework, in parallel with the formal review, using the design-specific review plans.

The second step is to focus on the HTGR designs and that would have them compare and contrast the proposed NGNP regulatory approach with the principles of the -- that were in the technology-neutral framework.

The third step would be looking at liquid metal designs. And there, it would compare that same general approach with whatever approaches have been developed for the liquid metal designs; and right now, they're talking of picking those ideas from international forums and ANS 54.1.

And finally, step four would be to consolidate all of those insights from the earlier steps to put forward a risk-informed performance-based regulatory framework recommendation to the Commission. Next slide,

We issued a letter on the staff plan in March of this year. And in it we said that the draft framework for near-term iPWR application review -- this is a good first step; it still needs to be tested and worked out in more detail. We also said that development of those design-specific iPWR review plans is really a very crucial step to ensure high safety standards are maintained for these unique designs, and that that development is closely linked to the development of

complete and stable designs.

Continuing on. We asked that they consider a PIRT-like process to guide development of the design-specific review plans. And there, we were just saying, “Come up with a scheme for identifying the most important issues and ranking them to make sure that they get factored into those design-specific review plans.” In the longer term approach, for license review of the non-LWR SMRs, the approach taken is really the logical extension of NUREG-1860, to develop design-specific frameworks. And that's consistent with our past reports on these issues.

And finally, the proposed pilot studies can provide necessary information for full development of a new framework, while not putting the licensing process in risk, because it's being doing in parallel with the first approach that was developed.

We note that sometime after our letter, in May of this year, you issued an SRM that approved the framework for iPWRs and approved the longer-term development of a new licensing structure. Slide 57.

Additional considerations that we have outlined. Staff has begun incorporating the lessons learned from recent design certification reviews into those design-specific review plans for iPWRs, and we were pleased to hear that. The risk-informed aspects of some anticipated SMR applications have indicated that they will require more thorough and complete PRAs available at an earlier stage than has been necessary for what's been going on for the design certs under Part 52, because they're actually trying to implement some risk-informed features into the designs. To do that, we think it requires a site-specific PRA or a PRA that somehow bounds the external events for a range of potential sites. I'm

not changing the slide. I just have my notes up here.

And finally, if these SMRs end up being selected for use in some remote and harsh environments, it could require specialization of data and design assumptions beyond that that's covered in the general approach. Next slide, please. 58.

And going forward, we look forward to following the staff's implementation of the proposed frameworks and resolution of strategies of related technical and policy issues. We did make note that some of these novel designs, proposed for some of the SMRs, highlight a concern we've been -- is growing, I guess, in the Committee. And that's that there is some need for criteria defining when experimental demonstration of predicted plant performance is needed to provide confidence in complex computer models. Some of these models are getting more and more complex, and are justified by referencing other computer models, and some where you need a link back to the real world. And that concludes it.

DR. KHALIK: Thank you, Dennis. That concludes our formal presentation.

CHAIRMAN JACZKO: Great. Thank you. We'll start with Commissioner Magwood for questions.

COMMISSIONER MAGWOOD: Thank you, Chairman. Well, first, at the risk of sounding like I'm repeating accolades given on Veterans Day -- this has nothing do with you guys, so just stand by for a moment. I always like to point out points of history that are important. Today is D-Day plus 67. And I always like to have the opportunity to meet veterans of World War II. I don't think there is any in the room. If there are, please let me know. But if you do know a

World War II veteran, please shake his hand today and thank him.

As for you folks, welcome. It's a great pleasure to have you again. I wanted to reiterate the Chairman's comments that we appreciate the great work that the ACRS has done. And I know it's been a lot of work. And I wanted to start with a very general question, just to make sure that in all the work that you're doing, do you have all the resources, the information, cooperation from the staff, whatever else that you need to do it.

DR. KHALIK: By and large, we do. There are maybe some specific cases where the staff's scheduling may not permit the sort of prompt transmission of information that the Committee needs, but by and large, we have the cooperation of the staff in all aspects of our review.

COMMISSIONER MAGWOOD: I appreciate that. Let me ask a question about the fire PRA. I know, one of the things in the ACRS's work, and I think in your comments today that came out on several occasions is that there does, in some cases, there is a dearth of actual empirical testing data. Has that -- have those requirements or those needs, weaknesses been clearly identified anywhere? Or is there anyone, at least, whether it's anybody doing the research on it. Or is it well characterized?

MR. STETKAR: I think the need for the research is well-characterized. NRC Research is aware of all of the issues that have evolved from both the performance of the fire PRAs for the pilot plants and more generically, in terms of the methods developments, through NUREG CR-6850. Scheduling the resources to perform the necessary testing, to support the derivation of that data is a separate issue. Research has a very well developed plan that identifies the required tests. Getting them implemented in a timely

manner, I think, is a bit of a challenge.

COMMISSIONER MAGWOOD: And that -- I imagine that includes the cabinet?

MR. STETKAR: It includes fire testing on cables is reasonably well developed. Fire testing on cabinets is in the plan, but it moved out a little bit on the schedule. And in many cases, resources of obtaining real cabinets with real inventories of actual, you know, cable material and what else is in there is difficult. It costs money to actually, you know, to find these things. So, it is a challenge to get that testing done. And then, as you know, it's rather expensive to perform the tests. So you need to tailor the test program to make sure that it's responsive to the needs of the people doing the work, which is a bit of the problem with the much earlier test data that's available, primarily from the early 1980s. Those tests were not performed for the specific purpose that the results are now being used.

COMMISSIONER MAGWOOD: That kind of echoes a comment that Dennis made at the end of his presentation, there is a, you know -- I don't want to call it a “fad” or anything, but there's certainly a lot of energy being put into computational methods to solve a lot of these issues. And I think the question about whether they're all being fed by empirical data or whether they're being fed by other calculations is a question mark.

MR. STETKAR: In truth, Commissioner, that's -- what we've seen is a lot of the work done, let's say in the late '90s, in terms of methods development was exactly that problem, in the fire area, where we're developing much more sophisticated codes to evaluate, let's call it the “fire physics of the problem.” They were derived primarily from earlier simplified codes, without the

underlying empirical data to verify the models.

COMMISSIONER MAGWOOD: Speaking of codes, I recall that in the, I wrote down the February 17 letter, you had some issues with the software that was being used for the PRA. I wondered if you -- has the -- what's happening in the intervening time? Have you resolved any of those issues?

MR. STETKAR: No. And in fact, in the letter, I think we were fairly careful to qualify that. The comments on the software were something that we obtained, both in our sub-committee meetings and from the interviews with the practitioners. That was simply volunteered as information about why they were not propagating the uncertainties. We didn't have the opportunity to do more in-depth review of what -- if real problems are, what the real issues are. And we haven't had any follow up meetings in that regard.

COMMISSIONER MAGWOOD: It's a question.

MR. STETKAR: It's still an open question. We made a clear recommendation to try to quantify and propagate the uncertainties. Whether that's being implemented in the current PRAs that will be submitted in the near term, we don't know.

COMMISSIONER MAGWOOD: Let me jump back to Dennis for a moment on the small modular reactors. I appreciated the letter. I thought the analysis you've provided was interesting. One question I had that always come to mind for me -- I ask this question a lot, so I thought I'd ask it today. Is there anything you're finding, as you go through the discussion about the framework for small modular reactors, particularly using the risk-informed frameworks, that is particularly unique to small modular reactors? Is there anything in what you've seen so far that makes you think that small modular reactors ought to be handled

in a fashion that's specifically different than you would handle any other reactor? I mean, aren't they just reactors? Or are the differences small.

DR. BLEY: I think that's a very interesting question. We have not looked at any small modular reactors as yet, as a Committee. We haven't seen any designs. We haven't gotten into them at all. We've only looked at these higher level documents. We've been informed a bit, and that's where that -- the one comment about the models comes from. There are assumptions that, yeah, these are just light water reactors and we can just use models we've had from before. And I think there's a general feeling on the Committee that we don't know that's true yet. And it needs to be examined. But I don't think we can address that definitively until we actually start looking at some designs. Now, some of our members have seen designs, but not as part of our work. Anybody else have --

COMMISSIONER MAGWOOD: Yeah, I was going to see anyone -- any other comment on that point. Excellent. Thank you very much. Thank you, Chairman.

CHAIRMAN JACZKO: Commissioner Ostendorff?

COMMISSIONER. OSTENDORFF: Thank you, Mr. Chairman. I want to join my colleagues also in thanking the ACRS for your significant contributions to the NRC and to the safety side; I appreciate your leadership.

I want to start out with Mike on the ISAs and PRA paper. And I want to talk about it, maybe bore down a little bit here. With expect to using a PRA approach to looking at human factors, human errors, can you talk a little bit about what we know about human errors in the fuel cycle arena, and maybe draw any comparisons to human errors in the power reactor side?

DR. RYAN: I'd be happy to, but Dennis is really our expert --

COMMISSIONER OSTENDORFF: Okay.

DR. RYAN: -- in this area. So I'd ask Dennis to answer the human reliability aspect of it.

COMMISSIONER OSTENDORFF: Okay.

DR. BLEY: Yeah, there are some things that are different. Because in -- we're talking about process plants here, and people involved in generally automated process plants, but at the place where people interact with that automation. There's a lot of work done in other industries, in the process industries in this area.

Staff has done some research and put together some beginnings of approaches for how they would like to deal with human error in those kinds of situations, but I think they can borrow from work that's been done in the process areas. And the people on staff who were involved in that have actually had some experience working on those other fields. So there's a lot of things that are -- that are more routine -- just making sure the process works. It's not generally like responses to events in the reactors. We have all the emergency procedures.

Some things we saw in other chemical areas were when automated processes had to be stopped because of problems and people had to go in and do maintenance. And I saw a lot of this done for the Army and their chemical weapons programs. One of the most common kinds of problems is you stop the process, you remove the material you were working on, you do the maintenance, you fix everything, you put it back together, and you put whatever you were working on one step further down the process than where it was when you took it off. And all of a sudden, it's not ready for the next step and problems happen at

that point. That kind of error was very important. And it's not the kind of thing we see a lot, except in some maintenance activities in the reactor plants.

So, it's more like the kinds of human reliability work that you do for maintenance activities in the reactor plants than it is like the emergency procedures. And there may be places where, in fact, it's more of the emergency procedure kind of operation, but I think that's not the bulk of the work.

COMMISSIONER OSTENDORFF: Let me follow up with one other question. Either Mike or Dennis, however you want to respond on this one, related. Mike, one of your slides talked about the use of ISAs in the chemical industry. Any commentary has the chemistry or chemical engineering refineries, large processing, the Duponts, the Dows, et cetera, have those big chemical companies looked to using PRA as part of a methodology to help them improve safety? Or are they strictly wedded to the ISA approach?

DR. RYAN: I think the answer is in part, the larger chemical industries, and Dr. Banerjee, who is not with us today, can address that more fully, do use PRA-like kinds of analysis. It's not a full-blown PRA, but they do evaluate risk information, particularly for high-hazard activities and high-hazard materials. But are they using full-blown PRAs, as we would in a rector? Probably not exactly.

DR. BLEY: Well, some are and some aren't. The ones who are that I've worked with don't share it with anybody. It's very proprietary. And so you don't get to see it. Again, the Army, with their chemical weapons destruction facilities, are process plants. They did a lot of it. But after 9/11, they took back most of what they'd had as public information and tried to pull it back in, although it was in depository libraries around the country for a long time.

COMMISSIONER OSTENDORFF: Okay. Thank you. John, I'll turn to some fire questions for you here. Same line of thought, asking, you know, Dennis and Mike about the chemical industry. Are there any industries outside the nuclear sector, where you and your efforts have looked at, to maybe glean some best practices on fire protection and approaches?

MR. STETKAR: Not from my personal experience. I think that my experience is that other industries tend to use standard industrial fire protection guidance, in terms of developing their fire protection plans. I'm not aware of any other industries. I don't know, Dennis, if you've seen anyone do a -- the type of integrated probabilistic treatment of fires that we've done in the nuclear business?

DR. BLEY: I've seen it in two places. Again, the Army's done a fair amount of it. And a couple of the -- driven by the air quality management district, out in California -- some of the refineries have done some of it.

COMMISSIONER OSTENDORFF: Okay.

DR. BLEY: But I don't think it's general practice.

COMMISSIONER OSTENDORFF: Okay. Dr. Ryan, on one of your slides, one theme that appeared to be there was there were a lot of site-specific, location-specific approaches. Are there any concerns that there is such a specificity to some of these analyses that you don't have sufficient harmonization across the board for the commercial reactors?

DR. RYAN: One topic we've taken up in part is that there's a very wide range of material facilities. A very simple fuel manufacturing, you know, that produced centered, you know, pellets of uranium and put them in fuel pins, all the way up to very complicated chemical processes with lots of organic solids

containing wastes that are going to be processed by combustion. So, that wide range of facilities, unlike reactors, where there's a fairly close envelope around them -- makes answering that question a little bit complicated, because you really have to define what part of this range of risk of very small risk, radiologically or chemically, up to high radiological consequence and lots of chemicals. I mean, for example, at the Savannah River site, we understand there are 13,000 IROFS, as opposed to a dozen. So, it's a very different range of environment, which makes it a more complicated question to answer. So, with that, John --

COMMISSIONER OSTENDORFF: John, and then -- thank you. And in the fire protection area -- harmonization question.

MR. STETKAR: Harmonization is a difficult issue. For existing plants, existing operating reactors in the U.S., the evaluation of fire risk is a very plant-specific issue, primarily because many of the decisions about electrical cable routing, which tends to be the most difficult issue to address in a fire PRA -- were done by the particular architect engineers. So even though you might have two nominally identical units, same vender, same nuclear design, issues that affect the fire risk of those plants may be very, very difficult, simply because one architect engineer decided to use one set of criteria for routing cable trays and a different architect engineer used the same licensing criteria but a different routing scheme.

You can use the same general methods to evaluate each of those configurations, but it requires a very, very plant-specific analysis to both identify particular fire hazards and the particular vulnerabilities, because those circuits affect different pieces of equipment. So, unfortunately for the current operating fleet, it becomes a very site -- very plant-specific analysis. Same general

methods, perhaps very different conclusions for two otherwise, what you might consider nominally, very similar plants.

Many of those issues become less important with the new reactor designs, that tend to be more standardized, both in terms of the actual plant design and configuration and more standardized in terms of the actual geometric layout of the plant.

COMMISSIONER OSTENDORFF: Thank you. Thank you, Mr. Chairman.

CHAIRMAN JACZKO: Commissioner Svinicki.

COMMISSIONER SVINICKI: Well, thank you all for your service on the Committee. And that extends of course to your colleagues who've not yet traveled in for your meeting this week, so I thank all of you. I'm going to start with fire protection, because I was listening carefully, John, to your answer to Commissioner Ostendorff. I had a similar question about all the site-specific approaches in the NFPA 805 license amendment request. But it was a little bit different. I was going to ask you if in looking at the pilots and the staff's review process, the Committee had found in any instances that we had perhaps needlessly overcomplicated the assessment. I've expressed, I think, publicly, an aspiration that I have that the staff's review could maybe, after the pilots, take less time than it has taken for the pilots. And, you know, we also wanted to have lessons learned that would inform the subsequent license amendment request. Did you identify any instances where, you know, frankly, we kind of maybe overcomplicated the process and we could approach it? I know you mentioned the component level as opposed to the site-specific analysis, but what's your assessment of how much efficiency could be gained there?

MR. STETKAR: I really can't comment on that because, unfortunately, as a Committee, we have not been involved in either of the pilot plant projects. We've not reviewed the staff's review of those submittals, so as a Committee, we're not in a position where we can comment on, you know, your concerns about resources or complexity of the reviews and things like that. I think -- the only comment I can make, from what we did learn during our investigations, is the pilot plants have provided, I think, a very, very valuable learning experience, both certainly for the industry, the people doing the analyses, and for the staff. The staff was developing their guidance and understanding of how to do these reviews, kind of in real time for those pilot plants. I know that they're -- the staff is developing or has developed, I believe it's still in progress, a lessons learned paper from those reviews. We've not seen that yet.

COMMISSIONER SVINICKI: Okay. Thank you. That's helpful. In the -- turning to the small modular reactor area and the Commission has directed the staff to prepare a Commission paper that will explore the feasibility of including risk-information and categorizing SSCs as safety-related or non-safety-related, and I wondered if the Committee could offer, in the area of small modular reactors, any considerations they might have identified, in terms of the feasibility of that assessment. And I guess, underlying the question is, if we can't get completely away from deterministically designating what is and isn't safety-related, how far -- do you have any thoughts about how far we could go in that direction?

DR. BLEY: I don't think there's anything unique here, for the small modular reactors. But I think we've seen enough to be able to say if they do

thorough risk assessments, then from that they can define the things that are important to risk. And, you know, you have this historical thing where we have important, safety-related, not safety-related, important to risk, not important to risk. It's a bit messy, isn't it?

The risk assessments, if they're done thoroughly, could let you identify what's important to risk. And that's about the best I think we can say on that. Otherwise, if you put together a thorough basis in framework for identifying those things, I think the distinction of safety-related, not safety-related could eventually go away, but you'd need a solid framework to get there. And right now, the traditional basis for coming up with safety-related, not safety-related, gives us an anchor point that I don't think you'd want to release until you had a -- and we haven't talked about this in detail, so this is just me speaking. But I think you wouldn't abandon that until you had a really solid framework for identifying what's important to risk that gave you confidence and considered uncertainty completely.

COMMISSIONER SVINICKI: And your letter report of March 16; it did have this statement. I think this probably has applicability broader than SMRs, but this was a statement that the Committee made in their report. “Experience has shown that initial use of simplified models to make preliminary risk determinations with later development of a more complete PRA should be avoided because that process will likely introduce inefficient and counter-productive review iterations as the SSC populations in each significance category change over time.”

I guess what I’d ask you about that -- so, that's what the Committee advocates to be avoided. Can you just, at a very high level, indicate what you

would recommend be done? Because it sounds like the recommendation is to start with a fully informed -- and produce a fully informed PRA. That doesn't strike me as being terribly realistic.

DR. BLEY: Would you prefer to address that, or shall I?

MR. STETKAR: You can start.

[laughter]

DR. BLEY: We've had a lot of concerns about, you know, shortcut first looks at dealing with this, and worries that maybe, if you start that way, it's hard to add the more important things to the list later on.

COMMISSIONER SVINICKI: But that is really the nature of how we develop and evolve a lot of analytical methods. So, why is it particularly problematic to you here?

DR. BLEY: We tend not to -- I have to be a little careful on this one. We tend not to make, if this is fair, regulatory decisions, shortcut analyses. We've developed a structure for doing rather thorough analysis that are put in place first. On the PRA side, we've seen examples of cases where people tried to take a PRA of something that's a little similar, and just make a few changes to it, and assume it was okay. And when you dig into the details, the risk really comes from the -- from the interactions among systems. When you have a well-designed system, independent, single failures aren't important, it's the dependencies that get you in trouble, it's the interfaces between systems that meet design rules but aren't quite aligned in the optimal way, and you don't see that until you dig in some detail. So we've seen that those kinds of analyses that don't look at the detail, often come up with a lot of gaps, and we're not sure when those gaps get filled. I think you might want to add a little to that.

MR. STETKAR: I think that that's a large part of the problem. A second part of the problem is that, unlike deterministic design analyses, PRAs develop a numerical value. You have a numerical value of core damage frequency, or a large early release frequency, or whatever metric you want to use for that particular analysis.

Initial PRAs develop an initial estimate of that numerical value. That numerical value then starts to take on a life of itself, and enhancements to the PRA to identify other contributors to risk, as Dennis mentioned, as you do more thorough evaluation of dependencies, of other possible contributors that you may have, for whatever reason, screened out in your initial simplified study. There's an inherent reluctance to admit, quite honestly, that they may increase the value of that numerical parameter. So if you're not careful about assessing all contributors in your initial study, even with a numerically conservative bounding analysis, not discarding things but including them, so that your initial study develops a truly maximum value for that estimated risk, which can then later be refined, you run a real risk of evolution of these studies that have the possibility of, I have to be careful about how I say this, but the possibility that there may be incentives to not increase the numbers. Let's just leave it at that. That's another one of our concerns --

COMMISSIONER SVINICKI: Ok, and, and --

MR. STETKAR: -- about doing the, sort of, simplified studies, especially where those simplified studies discount things, rather than explicitly including them, perhaps, with either a bounding analysis or an appropriate characterization of the uncertainties about --

DR. BLEY: If you could cover the uncertainties well, I think you can

do it, but it's hard to get people to do that and it's hard to do it yourself, thinking about what are the balance on things that you haven't modeled explicitly, and you have people saying well you haven't proved it's that way and --

COMMISSIONER SVINICKI: Well, and I wondered if it was really something at bottom that was that simple. John, I appreciate your candor because, again, the statement in the letter report says what you want people to avoid is initial use of a simplified model to make preliminary determinations with later development of more complete PRAs. So what you're saying is people get a number and they then want to only elaborate on their model to the extent it keeps that number or diminishes the risk. So it's human nature is what--

MR. STETKAR: And if a license is issued based on those decisions, it's very, very difficult to change that thought process later.

COMMISSIONER SVINICKI: All right, thank you. Thank you Mr. Chairman.

CHAIRMAN JACZKO: Our mess with GSI 191, but -- Commissioner Apostolakis.

COMMISSIONER APOSTOLAKIS: Thank you Mr. Chairman. John, on slide 24 the Committee concluded that excessive PRA conservatism may affect quality of decisions for post-transition risk-informed applications. I'm wondering why you don't think that, during the transition, the decisions may not be optimal because of excessive conservatism. I mean the licensee due to conservatism may be forced to do things that a realistic PRA would not justify.

MR. STETKAR: That's an excellent question and I think it's difficult for us, as a Committee, to answer that question because, as I mentioned, we were not involved in the reviews of the two pilot plants, which are the only things

that are available for us to base any conclusions on. We were told, both by the staff and by the two licensees for the pilot plants that, although the PRAs retain, for those two licensed, those two plants, do retain conservatism, the staff had done an appropriate evaluation of that conservatism for them to make, to draw the conclusion of reasonable assurance that the plant would be operated safely under the Risk-Informed Fire Protection Program. We did not receive any particular feedback from the two licensees that indicated that those residual conservatisms affected their decisions about actual modifications that they did make to the plant, and both of the licensees did, indeed, make reasonably substantive modifications to both fire detection and, in some cases, other hardware modifications in the plant, in response to those PRAs.

COMMISSIONER APOSTOLAKIS: Sorry, so it's, judging from your answer, you just don't know --

MR. STETKAR: We don't know because we haven't, we haven't looked at those two particular examples and they're the only two examples that are available.

COMMISSIONER APOSTOLAKIS: All right. Harold, I read the letter of the Committee and there was an interesting comment by Mr. Brown and Dr. Armijo. It has to do with squib valve post-seismic testing, and they give a reason why they want more evidence that these things would work, and then they use a somewhat strong language at the end saying that, in their opinion, it is incongruous to now conclude that the valve's critical to ensuring post LOCA passive long-term cooling will perform satisfactorily without post-seismic qualification prototypical operational testing, when, of course, we're spending a lot of resources trying to understand the phenomena during the re-circulation

phase and all that. My question is what is it that the Committee didn't like about this and it did not become part of the letter? Why is it only two members?

MR. RAY: Well, I can only, I don't have, as you would well know, Commissioner, a Committee answer to that question. I can give you my own opinion --

COMMISSIONER APOSTOLAKIS: I assume there were discussions Saturday afternoon --

MR. RAY: Indeed, there was --

[laughter]

MR. RAY: The, let me tell you what my feeling was, and I'll leave it at that; and that was there wasn't a sufficient demonstration, in my personal opinion, that doing the test after seismic qualification testing was required, given the design.

COMMISSIONER APOSTOLAKIS: I'm sorry, there was no --

MR. RAY: There was not a requirement to do a qualification test, post-seismic testing, that is a demonstration test that the squib valve would operate, after you had done the seismic qualification test.

COMMISSIONER APOSTOLAKIS: When you say there was no requirement, what do you mean? That it's not logically required or there is nothing in the books?

MR. RAY: Well there is nothing in the books and I didn't feel that it was a requirement that we should, that the Committee should impose. Again, that's just my personal opinion, and that judgment was based upon having done a lot of seismic qualification tests, as you might realize from California, and having looked at equipment, in this case the design, and asking myself, is it

necessary to demonstrate the operability of the valve after it's been seismically qualified, or not?

COMMISSIONER APOSTOLAKIS: So you're judging, then, that you have sufficient confidence in the reliability of the squib valves.

MR. RAY: The only issue at hand here is whether the seismic qualification test, or the subjecting the valve to a seismic shaking force, would affect the operability or the ability of the valve to perform its function and, given its particular design, my judgment was that it did not.

COMMISSIONER APOSTOLAKIS: Okay. Mike, slides 48, 49, and 50. First of all, let me start with what my impression of ISA is. If you read the report that says what an ISA should be, it's very nice, but then if you look at the applications of ISA, they vary a lot, and, first of all, there is no peer review, right, like we do in PRAs, it's a major omission here. When you say on slide 49 that ISAs, in combination with practices required by current regulations, are adequate for licensing and then in the letter you say that human reliability analysis is not done well, even though most of the accidents are human induced, I'm having a problem. Now, how do you conclude that they are adequate? Are you relying more on the judgment of people on other things, and the ISA is a small part of it?

DR. RYAN: I think so.

COMMISSIONER APOSTOLAKIS: So it's really not the ISAs that are adequate, it's the overall process --

DR. RYAN: Well, the overall process, and, again, I think what we're struggling with, and what I struggle with, is how complex is the facility and how detailed is the integrated safety analysis, the process has its analysis, or that one step short of a PRA.

COMMISSIONER APOSTOLAKIS: But I keep hearing that the ISAs produce the accident sequences. If the accident sequences do a poor job, including human performance, then I don't know that they're very good. And, again, I agree with you that it depends on the level of risk. I mean, some facilities deserve a more thorough review than others, but let's talk about the facilities that do deserve that more thorough review.

DR. BLEY: I think the one thing that allowed us to say what we said in the letter is that IROFs that are put in place are put in place to protect against human events as well as others. There's not a really thorough, human reliability analysis. There's not an extremely good dependency analysis, but for everything that the people who did the ISA, and the reviewers at NRC, could dream up in those lines, they put another line of defense in. So they build so much defense-in-depth against these things that, to me, it was convincing that they've lowered the opportunity. Now, the other thing is, for most of these facilities a hazard, especially the hazard to the public, is very small no matter what happens --

COMMISSIONER APOSTOLAKIS: No, I agree--

DR. BLEY: That's a big piece of the reason this looks okay; and the other piece is, for many of these facilities, not only is the hazard small, but the system's very simple. So the protections you can put in place are fairly convincing. So, given the way the rule language is written, it appears that they meet the standards of the rule with many lines of defense in-depth.

COMMISSIONER APOSTOLAKIS: Okay.

DR. BLEY: That's why we were convinced that it was, generally, okay.

COMMISSIONER APOSTOLAKIS: Now, one thing that bothers me a little bit when people talk about ISAs and PRAs, they're talking as if they were two different things, and, I mean, if the ISAs have produced, again, I'm talking for facilities that deserve such a treatment, not the trivial one, and there is also, people mention the excessive cost for doing a PRA, how much would it take to take an ISA and make it a PRA? Is that cost excessive?

DR. RYAN: I've never paid for one so --

[laughter]

DR. BLEY: Let me just do a couple simple things first, the problem, the risk is a probability and the consequences, and it's made up of those triplets of scenarios, likelihoods, and consequences, and that complete list of those triplets is the whole risk. The ISA does the scenarios pretty thoroughly, the ISA does some of the likelihood, it does it either in some qualitative ordering or it actually quantifies it, and the ISA does a bit of consequence analysis. Sometimes it's coarse, sometimes it's more thorough. So the ISA is the first cut of the PRA. Now, what's it take to get it good enough, we've had arguments, we don't have a position on that. Some of us think it's worry, that if you said you need a PRA, then the most thorough detailed analysis would be applied to every possible scenario no matter the consequence. My own belief is, if you applied reasonable considerations of those things, in many cases the PRA would be cheaper than the ISA, certainly for the complex facilities --

COMMISSIONER APOSTOLAKIS: That's why I raise the question because I see in many places, PRA versus ISA, and I agree with you that a lot of the work, the expensive work, that the PRA requires is already done, maybe to various degrees of perfection, in the ISA. So, really, we should be talking about

the additional cost and what it takes to get there. I have one more question?

CHAIRMAN JACZKO: Sure, brief, brief answer. You can have a long question but it's got to be a brief answer.

[laughter]

CHAIRMAN JACZKO: I can't do anything to control them.

[laughter]

COMMISSIONER APOSTOLAKIS: I want to come back to an issue that Commissioner Magwood raised, and I don't think the answer was addressed directly. The question was, is there anything in the staff's proposal for the regulatory system for the new regulations for the SMRs? Is there anything there that is really unique to SMRs? And I'll give you my answer, no.

CHAIRMAN JACZKO: Ok then, we don't need an answer from them.

[laughter]

COMMISSIONER APOSTOLAKIS: You said that --

CHAIRMAN JACZKO: Not yet --

[laughter]

COMMISSIONER APOSTOLAKIS: Your answer was, we have not reviewed the SMRs; we don't know the issues. That's a different thing. But what they propose in terms of classification, in terms of taking advantage of the performance-based requirements and reducing some of the analysis. So, I don't think that has anything to do with the fact that there small reactors. Okay, good, thank you.

CHAIRMAN JACZKO: That was pretty easy. I wanted to turn to -- back to the AP1000. One of the points that the Committee stressed in its letter

was the importance of the commitments being confirmed by the staff and then, ultimately, by ACRS. Do you have a plan right now? I know there's a REV-19 submittal, do you have a plan to review elements of that submittal currently, or is that not planned?

MR. RAY: It's not planned to the extent that it does not contain anything that deviates from what was presented to us, and we asked the staff to make that judgment.

CHAIRMAN JACZKO: Okay, so you're waiting on an answer from them, if there is a need, or do you have a committee or subcommittee that you could put that onto an agenda to deal with in the next couple of months, if necessary?

MR. RAY: Yes, sir.

CHAIRMAN JACZKO: Okay, thank you. The issues on the ISA/PRA are interesting issues and I think we've had a lot of discussion back and forth about those, and I think it's been a very interesting discussion. One of the things that I want to take a step back and just approach it from a different perspective, which is, namely, the goal here, ultimately, is to develop a better process for looking at the oversight of fuel cycles. We have gotten into a discussion about ISA versus PRA and, I guess the first question on that, there's been a lot of discussion about, and I think as Commissioner Apostolakis said, the facilities that might need it. I mean, has the Committee looked, I mean, with all of the fuel cycle facilities that are out there, how many of them fall into the category of the complex facilities for whom a PRA would actually be beneficial? Or do they fall more in those, I mean, are most of the facilities ISA-type facilities?

DR. RYAN: I think they cover the broad range, you know, fuel

fabrication's fairly straight forward with low-enrichment uranium oxide, make pellets, put the pellets in a fuel pen, and off they go, you know, up to thermal destruction facilities that have liquid solvents, toluene, xylem, and they burn them with radioactive material in it, in a very dynamic and active process. So, I think --

CHAIRMAN JACZKO: So which of the -- we're categorized by number of facilities. How many facilities do we license and regulate in those categories?

DR. RYAN: I do not know the answer.

CHAIRMAN JACZKO: I'm not sure of what facilities you were referring to in the last, your last comment.

DR. RYAN: A facility in Tennessee, Kingston, Tennessee it's a thermal destructive facility for mixed waste.

CHAIRMAN JACZKO: Okay, and that would be -- that's a facility, which, in your mind, would necessitate a PRA, now that is not a, and I believe --

DR. RYAN: That's an Agreement State licensed facility.

CHAIRMAN JACZKO: -- an Agreement State licensed facility, it's not an NRC licensed facility.

DR. RYAN: Correct.

CHAIRMAN JACZKO: Yeah, okay. So, of the NRC licensed facilities, how many of those would you say are of the complex facilities that would require the PRA?

DR. RYAN: I wouldn't hazard a guess at this point because we really haven't studied in detail how many would fit from the Committee's collective opinion, on my own, individually, how many would be in each category, but it's a good question.

CHAIRMAN JACZKO: Okay, so, sorry --

DR. KHALIK: I think people feel that that number is relatively small --

CHAIRMAN JACZKO: Small, okay, yeah, I think that's probably, my assumption is that is a fairly small number. Okay, well, I appreciate that.

DR. RYAN: If I may, Mr. Chairman --

CHAIRMAN JACZKO: Yes.

DR. RYAN: I think the fact that many of them are in Agreement States, and tend to be licensed under Agreement States, shouldn't fall away from our attention because that is a different scope of facility when they're not directly regulated and interacting with the NRC on a routine basis.

CHAIRMAN JACZKO: I mean, it's an interesting question because I think, as I said, the goal here we're trying to do is come up with a better oversight process. We don't dictate, necessarily, the oversight process, I don't think, to an Agreement State, per se. I'm looking to Mike Weber to get a sense from him. So, if the goal of the ISA versus the PRAs is to enhance, and fit in the, and make the fuel cycle oversight a better process, so, namely, we have some decision-making process to determine significance of findings. I mean, that's basically what we're looking at. So, if it's in a fuel cycle oversight perspective, which I think is what the Commission really asked for, not necessarily is ISA or PRA an unacceptable practice from an overall regulatory perspective, because I think that's a whole different question and I'm not sure, necessarily, that -- that's necessarily what I think the Committee was getting at either.

So, if we're really looking at, kind of, a back end or an input to the fuel cycle oversight, it seems like the ISA, for the facilities that we regulate, it

seems to have merit and value. Not that there couldn't be value in eventually getting to PRAs, but I think we -- I would hate that we lose the initiative to make enhancements to that process because we're going to require PRAs. We're still working with the PRAs and the fire side for the power reactors, so it's not a trivial process, I think, to get there but I think maybe, if someone were to listen this discussion, what they might be hearing is that ISAs are not an acceptable regulatory approach, whereas I think what we were looking at is are they a useful tool for informing the fuel cycle oversight process, or is PRA a better tool to do that? So I think that's a question that, hopefully, the Commission will continue to explore and move this issue forward because I think there is, ultimately, value in an enhanced process.

John, if I can turn to you a little bit on the fire protection, we had a little bit of discussion about, I think Commissioner Svinicki raised the issue of site-specific challenges to PRA, or to the fire protection PRA, I mean, it was commented on in the letter. Is that something unique to fire PRA or is that something that is an element as we develop and refine the PRAs more significantly? If you looked at the very first PRAs we did in the power reactor side, did they suffer from the same kind of challenges as we're seeing right now, as we develop these first round of fire PRAs?

MR. STETKAR: If you go back far enough in history, back in the early 1980s where people were taking an approach of sort of a generic design class PRA, which, in many cases, focused primarily on, what we call, a frontline safety systems, injection systems, feed water systems, and so forth, and did not do a very thorough evaluation of inter-system dependencies of support systems.

What we very quickly learned in the early 1980s is analogous to the

statement made regarding fire, is that, in many cases, the detailed design of those support systems, cooling water systems, electric power supply systems, ventilation systems, instrument air systems, was dictated by a particular architect, engineer. The details of those designs were different from plant to plant, even under the same architect or the same nuclear system supply. What we found was that differences in those parts of the physical design of the plant were very important to risk, in many cases. So we learned in the 1980s that you could not do a generic PRA, let's say for a Westinghouse, 4 loop-1000 Megawatt plant, and apply it to all of those plants because of the dependencies and support systems. Doing a fire analysis just raises the bar because it introduces not only the physical dependencies among all the support systems; it introduces geometric dependencies of how the cables are routed, with respect to specific fire hazards, in a location. That's yet another issue of plant-specific complexity.

CHAIRMAN JACZKO: And so, I mean, but the models that you're seeing in the plants are, and have you, did you review any of the PRAs?

MR. STETKAR: We did not. We have not seen any of them.

CHAIRMAN JACZKO: Okay, but is your understanding of the guidance basis, or the industry consensus standards, that they do need to do that level of specificity in the models --

MR. STETKAR: Oh, absolutely they do, absolutely.

CHAIRMAN JACZKO: Okay, so it is an issue that, again, if the PRAs are done appropriately, they're capturing that information.

MR. STETKAR: If they're done appropriately, they will capture that information. I think that's, the amount of effort that's required, both technical understanding and just plain resources, time and manpower, I think that's one of

the reasons why we've seen the issues regarding scheduling of submittals of these PRAs. I think that over the last three or four years, as the industry has started to do this work, the pilot projects being the initial efforts, they've discovered that amount of complexity and the need to actually evaluate it on a plant specific basis, that you can't do it generically.

CHAIRMAN JACZKO: Well, thank you, I'm turning to, and this isn't necessarily a topic that you all had touched on but one that I'm interested in your thoughts on going forward. We've seen with Crystal River challenging issues come up with containment performance, namely, the delamination that they experienced there. Seabrook is also addressing an issue with concrete and the performance of some of their concrete structures as a result of, what I know is, alkali silica reactions, but beyond that, I don't know much about it. To what extent is the Committee looking at these kinds of issues, in particular, some of the concrete integrity issues, as we go forward.

DR. KHALIK: Our license renewal subcommittee, as I indicated, performed a preliminary review of Crystal River and, at the time, that was before this reoccurrence, the Committee questioned the validity of the model that the licensee has proposed to ascertain that the process for restarting the facility will be adequate, and the Committee had requested a full review of that model, of course the subsequent events indicated that our concern was actually justified and that --

CHAIRMAN JACZKO: So you believe it was the, their model for the tensioning did not properly account for whatever --

DR. KHALIK: That was our original assessment of the process, and we have not had the opportunity to revisit that issue because we have not

been briefed on the model itself, even though we had requested that a subsequent meeting be scheduled for that purpose.

CHAIRMAN JACZKO: Okay, well, I appreciate that and I'll certainly think we can make sure to get that additional briefing done because, well there may be some time too before they move forward at all on that particular facility. Have you been briefed on the, has the ASR issue come up, that would be Seabrook, and the Seabrook license renewal so that one may just not yet have come to the Committee.

DR. KHALIK: It has not.

CHAIRMAN JACZKO: Okay. Well, again, I want to thank all of you for being here, and all those who are in the well, as well, and appreciate your continued service to the Commission, to the staff, and your efforts in nuclear safety. Thanks very much.

[Whereupon, the proceedings were concluded]