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U.S. NUCLEAR REGULATORY COMMISSION

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

Michael T. Ryan

John W. Stetkar

William J. Shack

Harold B. Ray

P R O C E E D I N G S

CHAIRMAN JACZKCO: We'll now -- we'll begin the ACRS meeting with the Commission, and we have three topics that we'll hear from the ACRS on today: Fukushima, of course, an overview of their work and then specifically on Fukushima, low level waste disposal and Level 3 PRA. And I think as the agenda demonstrates, the Commission relies on the ACRS to provide their independent expert perspective on a broad spectrum of important safety issues. With the many significant issues that the agency is currently examining, the Commission appreciates the ACRS's timely and thorough input.

And before we begin the presentations, I do want to take an opportunity to recognize Dr. Abdel-Khalik for his two years' service as chairman of the ACRS. I think, as I understand it, ACRS members are only allowed to serve up to two consecutive years as chairman, so this is Dr. Abdel-Khalik's last meeting as chairman. And the ACRS will elect new committee leadership at the December meeting.

Said's service as chairman came during a time of significant technical and schedule demands on the committee, with a number of design certifications, new reactor reviews. I think there were a total of five new reactor designs that the committee has looked at, safety margins for containment accident pressure, and, of course, the committee was able to turn around quickly and provide the Commission with very strong recommendations on Lessons Learned from the events at Fukushima.

Throughout his tenure as chairman, Said has represented the committee with distinction and so on behalf of the Commission, I want to thank you for your professionalism and your dedication as chairman and will look

forward to your ongoing contributions as a member of the committee. With that, I'd offer my colleagues if they'd like to make any comments.

COMMISSIONER OSTENDORFF: I'd just like to add my thanks, Said. You've been a terrific leader as chairman. You provided a great service not just to this agency but to the country. And we're very grateful for all you've done.

SAID ABDEL-KHALIK: Thank you, sir. My colleagues and I and the many ACRS members who came before us are proud to be of service to the American public. At this time, we will begin a summary of our --

CHAIRMAN JACZKO: You're not supposed to forget that. It's your last meeting. You've got to remember to push the button.

[laughter]

CHAIRMAN JACZKO: The last meeting as chairman, I should say, so. [laughs]

SAID ABDEL-KHALIK: Some of our members are not in attendance today just because of scheduling conflicts. So we will begin by providing a summary of our activities since our last meeting in June. Next slide.

Since our last meeting, we have issued 16 reports. Two of these reports deal with Fukushima. The first deals with our review of the near-term task force report and the staff's report on recommended actions to be taken without delay, the so-called 21-day report, while the second deals with our review of the staff's report on prioritization of the NTTF recommendations, the so-called 45-day report. We will talk in more detail about these reports later today. The two -- next slide.

The two other topics we will brief you about today are the proposed

rulemaking regarding site-specific performance assessment and human intrusion analysis for Part 61 and the options for proceeding with future Level 3 PRA activities. Next slide.

Additional topics covered in our reports include review of selected chapters of the Safety Evaluation Report with open items for certification of the US-APWR design and review of the Nine Mile Point Unit 2 extended power uprate application. Next slide.

We have also reviewed the license renewal application for Hope Creek and GE's topical report on the analysis of gamma scan data to support removal of the additional safety limit minimum critical power ratio margin requirement previously imposed by the staff on the use of GE methods for power uprate applications. Next slide.

Additionally, we have reported on our assessment of the quality of selected research projects submitted to us by the Office of Research as well as Revision 6 to BTP-719 on diversity and Defense-In-Depth in digital I&C systems and enhancement of the fuel cycle oversight process. Next slide.

Additional reports include review of Reg Guide 1.115 on protection against turbine missiles, Reg Guide 1.82 on water sources for long-term recirculation cooling following a LOCA, and three draft Reg Guides to support the proposed 10 CFR 50.46(c) rule on requirements for ECCS systems for LWRs. Next slide.

Finally, we have reported on our review of Revision 19 of the AP1000 DCD and the Final Safety Evaluation Report. We had previously reported on the design certification amendment for the AP1000 in December of last year, concluding that the amendment maintains the robustness of the

previously certified design. Next slide.

The conclusion in our December 2010 letter relied in part on statements and commitments made by Westinghouse on the record which were not fully documented in the DCD. These have been documented in Revision 19 of the DCD which were submitted in June 2011. The staff's final safety evaluation report was issued in August of 2011, and our review was completed during our September full committee meeting. Next slide.

The main changes in Revision 19 of the AP1000 DCD are the inclusion of additional finite element analyses of the passive cooling system tanks, inclusion of additional analyses of seismic and thermal load combinations of the enhanced shield building, inclusion of additional Tier 2 star information describing steel modules of the enhanced shield building, and an updated analysis of the containment accident pressure. Next slide.

In our letter on Revision 19 of the AP1000 DCD, we concluded that the proposed changes in the AP1000 design amendment maintained the robustness of the previous certified design and that there is reasonable assurance that the revised design can be built and operated without undue risk to the health and safety of the public. Next slide.

At this point, I'd like to move to ongoing activities. In the area of new plants, we are reviewing the design certification applications and associated safety evaluation reports for the U.S. EPR and the US-APWR. We are also reviewing the long-term core cooling for the ABWR and the US-APWR, the reference COLAs for ABWR, ESBWR, US-APWR, and the U.S. EPR and subsequent COLAs for the AP1000. We continue to complete our reviews promptly as the documentation becomes available to us. Next slide.

In the area of license renewal, our license renewal subcommittee has performed an interim review of Columbia and will perform interim reviews of Davis-Besse, Seabrook, and South Texas. The full committee is scheduled to complete the review of Columbia, Davis-Besse and South Texas in 2012. Next slide.

In the area of power uprates, we are scheduled to review Grand Gulf, Turkey Point, St. Lucie, Monticello, Fort Calhoun, Peach Bottom, and Prairie Island EPU applications as the staff complete their safety evaluations. We will also review GE's topical report on steam dryer integrity for power uprate conditions. Next slide.

Finally, this is a partial list of ongoing and future activities. The point to be made here is that while Fukushima-related reviews are and will be front and center of what we will be doing, we should not and will not be detracted from other important ongoing safety-significant activities. The Advisory Committee on Reactor Safeguards will continue to provide 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. That concludes that part of the presentation, and we'll move on to the next slide.

At this time, I'd like to move to the next topic which is ACRS review of Fukushima. Before I start, however, I'd like to make a personal comment. The Near-Term Task Force has done an outstanding job. They are to be commended on their effort. This agency should be proud to have men and women of this caliber working for it. Next slide.

The ACRS has had several briefings on Fukushima, beginning with an initial overview on April 7th provided by NRC staff who had served as part of

the NRC Emergency Response Team in the Operation Center. Subsequently, we were briefed by DOE, NEI, and INPO. On three occasions, the staff briefed us on activities of the Near-Term Task Force. And, most recently, during our October full committee meeting, we were briefed by the Fukushima Steering Committee on the staff's prioritization report. Next slide.

Consistent with Commission tasking, we have so far issued two letters on Fukushima. The first, dated October 13, provided our initial review of the Near-Term Task Force Report and the staff's report on recommended actions to be taken without delay. Our second letter, dated November 8th, presented our review of the staff's prioritization report. There is much work yet to be done. We will issue additional reports as we technically review action plans related to the specific NTTF recommendations. Next slide.

As we state in our October 13th report, while complete understanding of the Fukushima accident will take many years, the Near-Term Task Force Report and the staff's recommended actions to be taken without delay are appropriately focused on Lessons Learned from what is currently known. These are things that became self-evident to knowledgeable people as a result of Fukushima.

We also state that none of the NTTF recommendations or our own recommendations, particularly the Near-Term recommendations, will be negated or rendered inappropriate by the acquisition of new information from Fukushima. Hence, timely initiation of the recommended actions to be taken without delay is appropriate. Next slide.

Our October 13th report has focused on completeness and appropriateness of the staff's recommendations. We have recommended

additional immediate actions beyond those specified in the 21-day report as well as additional actions beyond those specified in the NTTF report itself. Next slide.

The following immediate additional actions were recommended in our October 13th report:

One, actions related to NTTF Recommendation 2.1 for seismic and flooding reevaluations should be expanded to include an expedited update of applicable regulatory guidance methods and data for external flooding.

Two, actions related to seismic and flood walk-downs should be expanded to address the integrated effects of severe storms. Next slide.

Three, regulatory actions related to station blackout should be expanded to include issuance of an advance notice of proposed rulemaking and requiring the licensees to provide an assessment of their capabilities to cope with an extended SBO. We understand that industry is already collecting that information in response to INPO IER1104 which should help inform the rulemaking process.

Four, actions related to the need for reliable hardened vents for BWRs with Mark I containments should also be applied to BWRs with Mark II containments. This recommendation has been added to the staff's 45-day prioritization report as a Tier 1 action. Next slide.

Five, discussions with stakeholders should be initiated regarding additional hydrogen control and mitigation measures in reactor buildings for BWR plants with Mark I and Mark II containments. Fukushima has demonstrated that merely inerting the containment atmospheres for Mark I and Mark II BWRs may not be sufficient to preclude the possibility of hydrogen explosions in reactor buildings. There are enough possible mechanisms for hydrogen release to the

buildings to make it an issue for all aging BWRs with Mark I and Mark II containments and not merely a peculiarity of Fukushima.

Six, information should be requested from licensees regarding current plant-specific fuel pool instrumentation, power supplies, and sources of makeup and cooling water. Again, we note that part of this recommendation has been added to the staff's 45-day prioritization report as a Tier 1 recommendation. Next slide.

And finally, actions related to the integration of onsite emergency response capabilities, namely the emergency operating procedures, the severe accident management guidelines, and the extensive damage mitigation guidelines should be expanded to include the fire response procedures. Experience from actual fire events has shown that parallel execution of fire procedures, abnormal operating procedures and emergency operating procedures can be challenging. We recognize that this action will be complex and will likely require significant time and effort. Nevertheless, we believe that this effort should begin immediately. Next slide.

The next set of recommendations in our October 13th report pertains to the NTTF report itself. First, we believe that performance-based criteria to mitigate and manage an extended station blackout should be considered as an alternative to the specific 8-hour, 72-hour and beyond coping times specified in NTTF Recommendation 4.1. Next slide.

Two, Recommendation 6 regarding combustible gas control should be expanded to include, as we said earlier, near-term Defense-In-Depth measures for hydrogen control in reactor buildings in BWRs with Mark I and Mark II containments and an assessment of the vulnerabilities introduced by shared

ventilation systems, or shared stacks in multi-unit sites. Next slide.

Three, selected reactor and containment instrumentation should be enhanced to withstand beyond design basis accident conditions. Next page.

And four, the NRC staff should proactively engage in efforts to define and participate in programs to capture and analyze data from Fukushima. Next slide.

Finally, in our October 13th report, we noted the difficulties encountered by the Fukushima operators in controlling containment pressure and that, as a result, the manner, timing, and procedural guidance for containment pressure control in U.S. plants will in all likelihood be impacted. Hence, we recommended that licensing actions requiring the granting of containment accident pressure credit for net positive suction head of ECCS pumps be suspended until these implications are understood. Next page.

At this time, I'd like to move to our second letter dated November 8th, which deals with review of the staff's prioritization of the NTTF recommendations. We concluded that the three-tier approach and criteria used by the staff in the 45-day prioritization report are appropriate. However, we offered several recommendations.

First, rulemaking activities to strengthen the station blackout mitigation capability should be expedited. We believe that 4.25 years for development and issuance of the final rule, followed by licensing and inspection activities of unspecified durations, is too long a time given the safety significance of this action. Next slide.

We also recommended that Tier 1 recommendations should be expanded to include the additional immediate actions recommended in our

October 13th report as presented earlier. Next slide.

We noted that the staff has ranked NTTF Recommendation 10 as a Tier 3 recommendation. However, Recommendation 10.2 relating to evaluation of the command and control structure and qualifications of decision makers will, in our view, be closely linked to efforts to enhance and integrate onsite emergency response capabilities. Hence, while we recognize that these efforts will be complex, long-term endeavors, we believe that NTTF Recommendation 10.2 should be initiated in parallel with Tier 1 activities related to Recommendation 8 on the integration of onsite emergency response capabilities. Next slide.

Our recommendations regarding the need to enhance selected reactor and containment instrumentation to withstand beyond design basis accident conditions and the need for NRC staff to proactively engage in efforts to capture and analyze data from the Fukushima event are judged to be Tier 2 recommendations. Next slide.

Finally, while we fully support the staff's recommended immediate actions to collect information from licensees on spent fuel pool instrumentation, we believe that schedules for spent fuel pool instrumentation improvements and other modifications to the spent fuel pool should be informed by quantification of spent fuel pool contribution to the overall risk. Next slide.

In conclusion, we believe that the staff's recommended actions are appropriately focused on what is currently known, things that became self evident to inform people as a result of Fukushima, and that none of the recommendations, particularly the near-term recommendations, will be negated or rendered inappropriate by the acquisition of new information from Fukushima.

Hence, timely initiation of these actions is appropriate.

We look forward to future engagement with the staff to technically review specific action plans for the various NTTF recommendations. At this time, I call on my colleague, Mike Ryan, to present the next topic. Mike?

MICHAEL RYAN: Thank you, Chairman Abdel-Khalik. Good morning, ladies and gentlemen. It's my pleasure to be with you here today to talk about the staff's proposal for revising 10 CFR Part 61, regulations for low-level radioactive waste management.

Two SECYs directed the staff to proceed with rulemaking to add site-specific analyses for disposal of large quantities of depleted uranium, to specify the technical requirements for the analysis, and to develop guidance that outlines the parameters and assumptions to be used in this analysis. This guidance also indicated that this limited rulemaking should not alter the classification of DU. The SRM also required longer-term direction that the, quote, "staff should budget for a future comprehensive revision to risk-inform the Part 61 waste classification framework."

The second SRM, SRM SECY-10-0043 also stated that the staff should include guidance that provides the circumstances for which large-scale blending of low-level waste is acceptable in the revision of the branch technical position on waste concentration and encapsulation. Guidance should specify and should specifically address homogeneity and the approach to include blended waste and performance assessments. Waste with greater-than-class-C concentrations are not excluded -- excuse me -- not included in the scope of this rulemaking. The next slide, please.

The system of dose limitation that underpins 10 CFR 61 should be

changed from a system that is based on outdated dosimetric models to total effect of dose equivalent system now in use that his consistent with current ICRP recommendations. This is an important change for radionuclides with half-life. And while not specifically related to Part 61, it does get to the root of the difficulty in dealing with some of these old concepts in a new risk-informed approach.

For example, 61.41 requires to limit the annual dose to an individual equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ to a member of the public. And this is a consideration that's included with ALARA. This dosimetric concept is from 1959, and it's not consistent with the current 10 CFR 20 dose requirements for protecting workers. So this mismatch is something that has to be dealt with.

I think worker doses, on the other hand, are being managed very well. Under operations for land disposal, must be conducted in compliance with the standards for radiation protection set out in Part 20. This to my knowledge is not a problem at any of the low-level waste facilities. They're very capable and able to manage worker doses well within those limits.

The disposal site must be sited, designed, used and operated and closed to achieve long term stability of the disposal site and to eliminate to the extent practical the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring and minor custodial care are required. Long term, hundreds of years, being funded by fees on disposal for ongoing monitoring and maintenance. And it's my understanding that, at least for one disposal site in the eastern part of the United States, they have a fund that's satisfactory for doing monitoring and maintenance for the foreseeable future on a fraction of the interest being earned on that money. So that's well within

capability of what people can do.

The proposed major changes to the rule 61.41 -- this is on the next slide please. There we are. Adds site-specific performance assessment requirements and add a Period-of-Performance for 20,000 years. 61.42 adds a site-specific intruder analysis, adds a 500 millirem annual dose for an intruder and also includes a Period-of-Performance of 20,000 years. Next slide, please.

Additionally, in 61.13 there is an addition of site-specific, long term analyses to consider the potential for long term radiological impacts and to calculate peak dose that would occur 20,000 years or more after site closure. Again, other changes that would be proposed include revision to incorporate the use of total effective dose equivalent and other conforming changes in concepts, definitions and technical analyses, operations and closure sections of the rule to make it consistent with major revisions. Next slide, please.

The ACRS recommends that Part 61 should not be amended as recommended by the staff, that assessment methodology should be risk-informed and performance-based. The Period-of-Performance should not be specified numerically in the rule, but it should be required that a site-specific and risk-informed analysis with respect to disposal technology and site characteristics be evaluated to determine the Period-of-Performance on a site-specific basis. Next slide, please.

This determination would include a risk-informed consideration of the radionuclide characteristics to be disposed. What is the dose consequence on a unit activity basis for each radionuclide, which is fine now? And other characteristics which include its waste form. What waste form is it? Is it soluble? Is it insoluble? Is it in a stable matrix? Has it been specifically stabilized for long

term disposal? And so forth.

Waste package: Is it a carbon steel drum that we can't count on for but a few decades, perhaps? Or is it a robust, welded stainless steel container that has lifetimes in the hundreds of years or maybe thousands?

Disposal technology: Is it disposal directly in the earth, where it's subject to environmental attack from geohydrologic processes in the near surface environment? Or is it disposal technology where advantage is taken for robust concrete vaults that are in place at various locations around the world, Dreg for example being one?

And cover technology: Cover technology's an important part of the disposal system because it provides the ability to take water away from the waste, and if you limit the contact of water with waste, ultimately you eliminate or reduce the migration of radioactive material from a disposal site.

The important thing I think to focus on in terms of risk is not the activity concentration in a particular container, it's not necessarily the entire inventory of a given radionuclide in a disposal site, it is the fractional release of radioactive material from the disposal system. And I mean system as a whole, which includes the waste form, the waste package, the disposal technology, the cover technology and the management of the geohydrologic environment. It is that entire system that's giving us safety, not the concentration in the waste form as we bury it.

So, that's a shift in thinking I think the committee in its letter is trying to convey that we believe that looking at it as a system and taking away specific time elements would be a better approach. Next slide, please.

So, if we decide that a site-specific Period-of-Performance is not

appropriate, we could also look at other guidance. IAEA talks about several thousand years. A DOE order uses 1,000 years for low-level waste assessment. And the NRC of course had 10,000 for a high-level waste assessment. And that's under some discussion and perhaps change. So there's a wide variety of numbers of periods used for various kinds of long term system performance assessments, and I think the message that we're trying to offer in our letter is let's just use that system of assessment and decide on a site-specific basis what might be appropriate. From my own experience, I would say that east of the Mississippi, where it's a human environment, is a whole different setting than west of the Mississippi, where it's dry and arid. You can see that there could be very significant differences in long term performance of sites in different geohydrologic environments by itself, so why not take advantage of our understanding of how to model those systems in a site-specific way? Next slide, please.

The ACNW has previously, during the period of 1997 and 2000, recommended a two-part approach. There are several letters on this topic. Site-specific time to address – gives you more time to address more radionuclides and evaluate doses for compliance? Provides a qualitative assessment without compliance measured to identify possible deficiencies in long term performance assessment. Those are parts of the strategy that could be used. Next slide, please.

The assessment longer than a few hundred years to 1,000 years should focus on major failures of a disposal system rather than a few intruders. It's -- and one commenter out of 15 on the proposed revision specifically supported the 20,000 year number. There are a wide range of opinions, but only

one endorsed the 20,000 year performance period.

Depleted uranium can be an acceptable waste for disposal in a 10 CFR Part 61 facility under certain circumstances. DU can be evaluated in a risk-informed performance assessment fashion and I think I've outlined to you in my comments. For example, in addition to having robust disposal technology, you could consider a range of depth of burial. We always think that near surface will involve an intruder. There must be some depth of burial below which an intrusion is not as likely and can be discounted as a possible pathway for exposure.

Another important feature is if you consider the radioactive materials that are in low-level waste, there's only a handful of radionuclides that will persist past a few hundred or 1,000 years. Namely, a little bit of carbon-14, I-129, uranium-238, technetium-99 and neptunium-237 will be available for longer term residence in a disposal site. And again, at very small total integrated quantities of radioactive material. A small number of curies will be remaining in a very large volume of waste. Next slide, please.

The original Part 61 intruder analysis was a simplified bounding calculation to establish concentrations for certain radionuclides. More realistic inadvertent intruder scenarios that consider site-specific factors should be used with a risk-informed approach. For example, I posed the question, "When does an inadvertent intruder become an advertent intruder?" If there are barriers to intrusion, if there are robust engineered features and in fact there could even be plaques that indicate, "Radioactive Material. Do not dig" in however many languages we decide to do that. You certainly could make an inadvertent intruder become at least aware that he's penetrating into something that perhaps needs more attention or understanding. So more realistic inadvertent intruder

scenarios that consider site-specific factors should be used within a risk-informed approach. Again, most low-level waste is decayed away with only a small number of radionuclides persisting past about 300 years.

One point that troubles me a little bit about 20,000 years is the half-life of uranium is 4.5 billion years. I don't understand why if a 10,000 year assessment is inadequate why a 20,000 year assessment is any better. It's at the same activity level it was at 10. So, I just want us to think about risk informing it rather than these specific, pre-determined timeframes.

I think there's one other issue that troubles me a bit and is the probability of intrusion. If you have a right circular cylinder of, say, 12 feet in diameter buried in a 400 acre site, the random probability of hitting that is about 7.6 times 10 to the minus 6. So, one in a million probability of hitting a particular container that might have waste you don't want to intrude on. So, I think at some point the probability of actually intruding into a specific waste that's isolated in a specific way also needs to be considered. That's also part of risk informing what the likelihood is of intruding into these wastes.

So with that, I'll conclude to say greater emphasis on a risk-informed approach for low-level waste management should be considered and it should focus on radionuclide quantities rather than the origins of wastes or their concentrations, because it's the quantity disposed that really is the best starting place to do a risk-informed assessment. Realistic treatment of intruder protection, including probability and consequence of intrusion and other parameters including depth of burial and performance of intrusion barriers over the longer haul should be evaluated and considered in a risk-informed way. Thank you very much for your time and attention.

JOHN STETKAR: Good morning. I'm happy to be here. I'd like to briefly inform you about our deliberations on the topic of options for proceeding with a -- well I'll characterize -- a full-scope level 3 probabilistic risk assessment. First slide, please.

Just to remind you, the staff developed a SECY paper, 11-0089, that proposed three options for level 3 PRA. Option one, which is characterized as status quo. An evolutionary approach to development of PRA technology. Option two was the performance of focused research to address currently identified technology gaps in areas that require additional information before proceeding with the performance of a full scope PRA. And option 3 was actual performance of the full scope level 3 PRA. Next slide, please.

We reviewed this issue during subcommittee meetings a year ago in November, 2010 and in May of this year. We had a full committee meeting in June of this year, and as a result of our deliberations, we recommended a modified version of option 3. In other words, proceeding with the full scope level 3 PRA. And I'll provide a little bit of the background on that decision as we go on.

The SRM was issued in September of this year and the Commission indeed did approve a modified version of option 3, so that's -- we're happy to hear that. Next slide, please.

There are several questions. You know, why should we perform a level 3 PRA now? What's the benefit of doing that? We're going to try to address some of those questions I think in the next slides. There have been substantial analytical advances since the agencies last efforts to perform a level 3 PRA in NUREG-1150. Recognizing that our knowledge base, methods, data

and so forth to support that activity are now at least 20, if not 25, years and in some cases more outdated. There have been substantial advancements in PRA methods, in particular for treatment of human reliability, fire assessment, seismic risk assessment, evaluation of other external events, high winds, flooding and tornadoes et cetera. We've substantially improved our understanding of severe accident phenomena for the entire fleet of designs that are out there. We now have not fully implemented but very close consensus methods for evaluating the risk during shutdown modes, low power and shutdown modes. And we've made substantial improvements in the characterization and methods to quantify various sources of uncertainty in the analyses. Next slide.

The industry has also made very, very significant advances in the last quarter of a century. Plant operations and maintenance have improved substantially, initiating event frequencies that were used in NUREG-1150 have reduced substantially. Plant availability is much, much higher. Equipment failure rates in general have been reduced because of improved surveillance and improved maintenance. And indeed, maintenance unavailabilities have been reduced because of greater attention to risk in terms of plant configurations.

Several plants have also implemented hardware modifications to address many of the most important contributors to risk. In particular, risk to core damage, because people have focused primarily on core damage as a major indicator of potential risk. Many plants have implemented risk-informed configuration control. This is part of the maintenance rule program. And it's been extended substantially into low power and shutdown conditions when you do outage maintenance planning, for example.

Severe accident mitigation guidance has been implemented. Both

the severe accident mitigation guidelines and the extreme damage mitigation guidelines have been implemented over the last -- primarily the last decade or so. And there have been substantial improvements in emergency planning that will continue with the new rule. Next slide, please.

What are the benefits of performing a level 3 PRA? In my opinion, the first bullet is the principal benefit. It's a fully integrated assessment of the offsite risk. It's not a partial or truncated assessment. That fully integrated assessment provides the framework to identify important linkages and dependencies. Both physical dependencies based on the potential damage to physical structures, the equipment. Functional dependencies, linkages between containment heat removal and core heat removal, for example. And of course human dependencies are always important when we start thinking about accident scenario evolution.

Level 3 PRA now I think will give us an updated and more balanced understanding of the current risk profile from our nuclear power plants and the contributors to that risk, recognizing all of the advances that I summarized in the preceding slides. Next slide, please.

Option 3 versus option 2. There's been some discussion about that decision. First of all, let me say that the ACRS fully agrees that additional research will be needed to address specific issues. We don't mean to imply that we know everything about all of the potential areas that will require examination to complete a full scope level 3 PRA. However, that being said, we think that performance of the level 3 PRA provides an important scenario-based context and focus for those research activities. It asks the questions that need to be answered in the context of the risk assessment, rather than attempting to identify

broader scope issues a priori.

It's also important to note that the level 3 PRA itself may identify other important knowledge gaps that require solutions. This has always happened every time we've tried to do a full scope risk assessment we've identified problems that we hadn't anticipated. There's no reason to expect that that wouldn't be the case here.

In that context, there tends to be an effort to apply simplified or bounding assessments to areas where you haven't quite thought about the most pragmatic way to solve the problem. We also have experience from the past that sometimes those simplified and bounding assessments can skew the risk profile substantially and therefore if we want to really understand the risk and its contributors we should try to avoid that type of approach. Next slide, please.

This is a little bit of a busy slide, and if you read our letter, the focus of this slide is sort of buried in the middle of a paragraph. So I thought that it might be worthwhile to bring it up to the surface a bit. We noted that the interim results from the level 3 PRA should benefit from an integrated assessment of the level 3 risk for specific hazard categories and plant operating states. What does that mean? If I can think of the risk assessment process in terms of horizontal slices and vertical slices through the risk assessment, where, if you'll allow me, a horizontal slice starting from the initiating event progressing through core damage, containment performance, offsite releases and then offsite consequences, versus a vertical slice which, for example, would look at core damage through all plant operating modes. We believe that approaching the problem in the horizontal or fully integrated perspective provides the most important near term technical benefits from this process in the event that the

schedule for the entire fully integrated level 3 PRA becomes delayed because of resource constraints, because of issues that arise that require more detailed research activities and so forth.

So, the sub-bullets on this slide are an idea about how to organize that sort of horizontal slice through the risk assessment process to maximize the information and input to the regulatory process in the event that the schedule gets delayed. Next slide, please.

Something that is very, very important to the entire project is to maximize the benefit from the available technical information. This is going to be a major project. The project should benefit from active participation and collaborative input from industry, EPRI, in particular, NEI to the extent that's practical, perhaps individual utilities. The selection of the participating plant site is essential to start the project. The staff has noted that no single plant site in the country satisfies all of the desirable attributes that they listed in the SECY paper in terms of available level of PRA, other in terms of SPAR models or even plant-specific PRAs that performed multi-unit site attributes and so forth. So there's no perfect site to simply go out and say, "Well, this is the place." We should select that site based on all of the available information, including incentives for the industry to participate. Obviously, we should benefit from the existing SPAR models and plant-specific analyses and other agency activities that can support this effort, in particular SOARCA.

Our letter recommends that it may be prudent to select a pressurized water site simply because the lessons learned from Fukushima may change our understanding of BWR, degraded core and accident phenomena. So, if you had a choice -- if there are two equal sites and one was a pressurized

water reactor, one was a boiling water reactor, we would recommend that you choose the pressurized water reactor site simply for those reasons. Next slide.

Quantification of uncertainty. It is essential in the second decade of the 21st century that we characterize and quantify our uncertainties and risk. I think that's important for the agency, I think it's important for the American public to understand what those uncertainties are in a quantitative sense. Everyone says, "Well, quantification of uncertainty is very difficult. We don't have appropriate methods." We can always improve our methods to quantify uncertainty, but our current methods have evolved substantially over the last decade or so and we believe that the current methods indeed are adequate if they are applied in an integrated fashion. In other words, scenario-based end-to-end. Next slide.

What are the benefits of doing a level 3 PRA? There are many. The first benefit I think is very important and often overlooked. We in the agency have an aging staff, as much of the industry does. We have a few folks who actually participated in the NUREG-1150 analyses, and they are some of our most valuable people in terms of their experience and firsthand knowledge. I think it's important to give our staff that information and that experience so that they can carry that forward into the next generation of folks.

As I mentioned earlier, this perspective of integrated risk I think is important both for plant owner-operators, for resident inspectors as they go by their daily activities of evaluating risk significance of particular events and also for headquarters staff. I think that a level 3 PRA is obviously an important input to emergency planning decisions. Certainly a potential input to resolution of some fairly thorny, generic issues, GSI-191, -199 come to mind, for example. And it

provides a quantitative framework to address new reactor designs and siting issues. For example, small modular reactors which have been trying to take advantage of perhaps more localized emergency planning zones. And with that, I'll turn it back to you, Mr. Chairman.

SAID ABDEL-KHALIK: Thank you, that completes our presentations.

CHAIRMAN JACZKCO: Well thank you very much for very interesting presentations. We'll start with Commissioner Ostendorff.

COMMISSIONER OSTENDORFF: Thank you, Mr. Chairman. Thank you all for your briefings, as one of the glories of being a commissioner is a chance to learn from world class experts and I learned a lot this morning. So, thank you for your presentations.

Said, I'm going to start out with some Fukushima-related questions. Just a big picture. Earlier this month, INPO issued this red book that has, at least as of that point in time, the best understanding of the sequence of events at Fukushima. And I realize this came out recently. You may not have had the chance as a body to review that, but are you aware of any significant differences and understanding of what happened that might impact either the Near-Term Task Force or the ACRS's views on top priorities.

SAID ABDEL-KHALIK: As you're well aware, Commissioner, the committee has not discussed the INPO report regarding the Fukushima timelines. Nevertheless, I'm confident that members have read the report and if you wish, I can give you my own views.

COMMISSIONER OSTENDORFF: Please.

SAID ABDEL-KHALIK: First, nothing in the report negates or

renders inappropriate any of the NTTF or our own recommendations. So, the statement that we make in our letter is true.

However, the report emphasizes the importance of some recommendations and for me two stand out. The first is the fifth bullet of NTTF recommendation 9.3 regarding providing the means to power onsite communication equipment during an extended station blackout. This particular recommendation is appropriately ranked as a Tier 1 recommendation. And if you think about it, presumably auxiliary operators, the people that we call System Operators or non-licensed operators are trained to converge on the control room when they lose communication with the control room staff. And what that means, that, you know, initiation of actions is delayed by that much.

More importantly, when these people actually converge on the control room and receive their verbal instructions and then they're dispatched to the field to take specific actions, the control room staff will not know whether these actions have or have not been successful until these people come back. And therefore, in essence what this means is that the time constant of the event is actually stretched. The time constant of the event is stretched by the communication time between the control room staff and the people in the field, which means that if there are time sensitive actions, those might be missed. And therefore, this is sort of something -- a big picture thing that stood out for me.

The second big picture thing that stood out was the report clearly illustrates the impact of hydrogen explosions. Not only the damage they directly cause, but also the fact that they may severely and extensively hinder the response effort that's ongoing. And that was demonstrated in two cases where temporary equipment and cables that were laid out by the staff were actually

damaged by the steam explosions and they had to, you know, account for all the personnel, et cetera. And what that means is that the point we make in our letter regarding the need for Defense-in-Depth measures against hydrogen explosions in reactor buildings for plants with Mark I and Mark II containments is clearly valid.

The third thing, you know, a big picture thing, and it is not technical but it's somewhat philosophical and if you allow me, there's a good reason why nuclear plants are not and should not be fully automated. The ingenuity, resilience, determination and generosity of spirit of the operators at the Fukushima Daiichi plant are the stuff of poetry. I am quite sure that if an event of the same magnitude were to happen here in the U.S., our operators would equally rise to the task. Those are the three big things that I learned from reading that letter, and I invite my colleagues to provide further comments based on their own reviews at this time.

COMMISSIONER OSTENDORFF: Please feel free, if anyone has any comments. Okay. That's very helpful, thank you for sharing your perspectives.

SAID ABDEL-KHALIK: Thank you, sir.

COMMISSIONER OSTENDORFF: Let me continue on with the Fukushima Lessons Learned and get into one of your specific discussion points on station blackout. You know, there's two points I want to try to get to in the four minutes that are remaining here if we can. One deals with the expedited nature as opposed to the normal four years to get to rulemaking. And the second deals with the performance-based approach versus as an alternative to coping times.

So I'd be interested in you talking two things, and please have your

colleagues join in as appropriate. One is, in order to get to an expedited activity here, I know you have an ANPR recommendation to move this thing forward, I personally believe that expediting this is a good thing to do. We've talked about that before. But how might the staff approach this in a different way going forward to do this in a shorter time period compared to our historical rulemaking? And secondly, if you can comment on the different approach of a performance-based as opposed to these standard coping times, 8, 24, 72 hours, and do we run the risk of there being a hodgepodge of different solutions out there depending upon which site we're talking about.

SAID ABDEL-KHALIK: Right. Let me just address the second point first. There are four functional requirements that need to be met. And these are core cooling, containment integrity, RCS integrity and spent fuel pool cooling. And what we're saying in addition to these specific timelines that the staff is recommending, we should look at performance-based criteria where licensees are allowed to demonstrate that these four functional requirements can indeed be achieved and maintained during an extended station blackout. We're not saying that you should not under any circumstances use the eight hours/72 hours/beyond recommendation that the staff is doing -- is recommending -- we're saying during the rulemaking we should consider that possibility because perhaps that specific timeframe, eight hours, 72 hour and beyond, may not be optimal for each and every site. That's what we're saying.

The coping time for extended blackout doesn't just depend on the life of the batteries. It may depend on a lot of other things. It may, for example, depend on the capacity of the condensate storage tank. It may depend on the length of time it takes for the RCIC pump room and the turbine-driven aux feed

water pump room for PWRs to heat up beyond the temperature at which these equipment are qualified. And therefore, to specify specific times where either equipment that are already hooked up or equipment that are available onsite can be hooked up to provide the 72 hours or anything that comes from offsite would be called upon to maintain these four functional requirements may not be optimal for all sites. That's all we're saying.

Now, as far as extending or, I mean, accelerating the rulemaking process, all we're saying is that in our judgment, given the importance of this particular recommendation, the timeline specified in the 45 day report, where you have 4.25 years for rule-making followed by unspecified times for all the follow-up regulatory action, is just way too long for an important action of this type. That's what we're saying.

COMMISSIONER OSTENDORFF: Just real quick and just very -- let me just -- few seconds here. Is it you -- to follow up on that point, is it your sense that this is not a Ph.D. or dissertation project, that it's not rocket science, that we know enough to be able to move forward in a fairly responsive, quick manner?

SAID ABDEL-KHALIK: Yes, sir.

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

CHAIRMAN JACZKO: Commissioner Svinicki?

COMMISSIONER SVINICKI: Well thank you all for being here and for your presentations, and I know some members are not here today but I know they're probably viewing or will view this meeting subsequent. I think this is a very important meeting that we have with the ACRS and the Commission. As a

member of the Commission, I certainly benefit from all of your expertise.

Said, I might start out with a question that's kind of in your capacity as chairman, and maybe it's a bit administrative but you had a very lengthy list of other activities that you'll be balancing against the emergent work on Fukushima. I was going to ask you, of course people always look at a list and notice what's not on the list but there were a couple of items. The NRC is of course proceeding with looking at the conduct of a rather extensive cancer study. I'm certain that the committee is aware of that activity and we've had some engagement with the National Academies and in other public meetings on that. And the other is that the NRC staff has underway a valuation of potential revisions to radiation protection regulations to perhaps make them more contemporary with the ICRP recommendations. Could you describe what the ACRS envisions in terms of any involvement or review of those two activities?

SAID ABDEL-KHALIK: I --

MICHAEL RYAN: I can certainly help out.

SAID ABDEL-KHALIK: Please.

MICHAEL RYAN: We've been tracking -- excuse me -- we've been tracking the involvement that the NRC staff has had on these issues and at this point I think we're in an information gathering mode as well as they are and, you know, what exactly their plans are going to be and I think we would probably be in a position to offer an opinion when they do have a -- kind of a formal plan of what the next steps might be.

COMMISSIONER SVINICKI: At that point you would evaluate as a committee what kind of evaluation or role you might undertake?

MICHAEL RYAN: And I think we would do that with our normal

process of perhaps one, maybe two, sub-committee meetings as things progress, and then a full committee meeting with a letter to follow on any advise we might offer to -- offer comment or endorse their path forward.

COMMISSIONER SVINICKI: Okay, but you're monitoring --

MICHAEL RYAN: Yes, absolutely.

COMMISSIONER SVINICKI: Okay, thank you.

MICHAEL RYAN: And I do think it's an important activity for the staff. That's my own personal opinion. That, you know, we consider the ICRP and how we can comport with these recommendations that are coming forward and it will improve our own system of dosimetry as well as the cancer study, which will update hopefully our understanding of cancer risks for radiation exposure, as well.

COMMISSIONER SVINICKI: Okay, thank you.

MICHAEL RYAN: You're welcome.

COMMISSIONER SVINICKI: This is well and perhaps you could leave your mic active because I had a follow up question, or somewhat related question for you. When I joined the Commission, a decision had been made to dissolve the Advisory Committee on Nuclear Waste and fold those activities back into the Advisory Committee on Reactor Safeguards. I would be interested in your view of how the balancing of the workload related to issues that formerly would have been studied by the ACNW, how is that working to have those activities now blended back in with the ACRS? I know that as I go about following the selection of candidates for the ACRS, I still think that there's a focus on a lot of the reactor related activities and I'm not indicating that having you represent or carry a lot of the expertise related to nuclear waste and some of the

health physics related issues is in any way inappropriate but something that I think when I've observed ACRS drafting sessions and sat in the audience, I think those on the committee who are responsible for reactor related issues have the benefit of a really healthy give and take with other experts on the committee from across the country and I'm wondering if you have the opportunity to have a broad give and take with other ACRS members when I think a lot of them have strong reactor backgrounds, does too much of this end up being singularly falling on your shoulders and do you think going forward the Commission ought to be looking at perhaps augmenting, you know, as members leave the committee and new members come, perhaps more experts in fields that you are expert in.

MICHAEL RYAN: Well, I think, certainly it would be great if there were 15 health physicists on the ACRS.

[laughter]

That's not going to happen. I do think, however, and I give credit to each and every one of my colleagues, they do have experience in areas that are valuable to radiation protection questions, whether it's risk assessment, probabilistic risk assessment, deterministic risk assessment, modeling activities, whether it's radiation dosimetry or transport for the environment or heat transfer in a reactor, it's all the same kind of mathematics and basis so I'm proud to be a graduate of our chairman's program at Georgia Tech for example, where health physics and nuclear engineering were -- I wouldn't say exactly transparent but there was a lot of overlap in those activities so I would say for the moment, there's a very robust subcommittee on these issues, when everybody actively participating, I'd invite you to come to a subcommittee meeting or two to see how that works and I think when issues come from the subcommittee to the full

committee I'm very pleased that everybody's actively engaged and offers great help to that subcommittee as we all try to do for every subcommittee, although in thermohydraulics I'm not going to make a huge contribution, but I try my best to participate fully in the subcommittees where I'm not the lead or the expert. So it's a collegial body and well done all around and you know, even our newer members we got to add some additional skills that will be helpful in the areas of interest to me.

So I would say for the moment it's working great, but I encourage you to, you know, again consider in any open position what's the appropriate skill set to help us augment and hopefully we can have that discussion through our chairman, you know, when that arises. So we look forward to that. Thank you for asking.

COMMISSIONER SVINICKI: Okay, thank you. Thank you for that assessment. Said, I wanted to -- this isn't really a question but my colleague Commissioner Ostendorff asked you about the INPO -- recently published INPO timeline of accident progression at Fukushima. I wanted to note -- I appreciate your observations about that and I realize the committee hasn't fully deliberated on the impact of that document and frankly, I know there will be other key documents to be published in the coming months and years that will, of course, be assessed in terms of the recommendations that you are making or that the regulatory response that NRC has underway to the Fukushima events, but I would note that I appreciated in the November 8th letter the ACRS, I think, at least made passing reference to the importance of command and control structure and the qualifications of decision makers. I would just comment back to you that the INPO published timeline very much by design does not address

those issues. I think that the ACRS in its November 8th letter at least mentioned the importance or how, as we learn more about command and control structure and how decision making progressed in Fukushima that could have a bearing on some of the actions that we might take going forward and it could in some instances have a pretty significant impact to how we would evaluate any regulatory changes we would want to make here.

So I guess I mention a little bit that the -- that there were key things that were not in that -- in that INPO document that I think we will learn more about in the coming months and I think -- again, I appreciated that the ACRS had indicated the importance of some of those -- some of those issues.

The other thing I might ask you to elaborate on is not -- couple of times the ACRS has mentioned or recommended that the staff continue to engage very actively in review of -- I want to get this right, proactively engage in efforts to define and participate in programs to capture and analyze data from the Fukushima event. Do you have specific forms that would take that you're indicating when you make that generalized recommendation about being proactive in engaging in efforts to capture and analyze data? Is this a cooperative effort with the Department of Energy, is it sending NRC experts to participate in international review teams that go forward, is it all of those things or are there key specific activities that are imbedded in that recommendation?

SAID ABDEL-KHALIK: Well I think the operative words in that recommendation are to define and participate in. Not just simply fund work or enter into agreements with some other agency to do the work, but as far as specific things, let me call on my colleague, Joy Rempe to talk about this specific recommendation.

JOY REMPE: Thank you. As I'm sure you're aware of, after TMI we learned a great deal about severe accident progression because it gave us an opportunity for a full scale experiment, so to speak, and we learned a lot about source term melt progression, but with respect to full scale examples, we don't have that opportunity with BWRs. Likewise, there is maybe some opportunities for ex-vessel phenomena in better -- to provide an understanding of ex-vessel phenomena. So as Said said, I think that it's very important that the U.S. actively participate in defining that data, that we'd like to see and not just sit back and obtain whatever data we can indirectly from Japan, but if possible, to -- which requires money, go forward and try and gain that insight.

COMMISSIONER SVINICKI: Okay, thank you and just very quickly, I had one last question. The ACRS has looked at the Tier 1 activities and then recommended that they be expanded, I'm certain that you've heard, maybe this is a trite phrase but if everything's a priority nothing's a priority, you know that phraseology. Do you think that everything in Tier 1 is of equal importance in terms of its immediate kind of effect on safety? Do you think that there needs to be any kind of look at a sequencing or prioritization of activities within Tier 1? Do you think the NRC staff, even of its own accord, would benefit from doing that?

SAID ABDEL-KHALIK: I believe so. I mean, the example I gave about the fifth bullet of recommendation 9.3 that stood out as a very important thing, being as much as maintaining communications between the control room and people out in the field during an extended station blackout is a very important thing, because without it the time constant of the accident is expanded. So it clearly, within that sort of big group of recommendations to fall under Tier 1

recommendations, there's still a prioritization to be made.

COMMISSIONER SVINICKI: Okay, thank you.

SAID ABDEL-KHALIK: They're not of equal --

COMMISSIONER SVINICKI: Impact.

SAID ABDEL-KHALIK: Immediacy or impact, yes.

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

CHAIRMAN JACZKO: Commissioner Apostolakis?

COMMISSIONER APOSTOLAKIS: Yeah, I'm sorry.

CHAIRMAN JACZKO: If want to pass, you can --

[laughter]

I just go by the card, I don't think about it.

[laughter]

COMMISSIONER APOSTOLAKIS: Wow, okay. Again, regarding Fukushima. Do you think that the issues that have been raised and the recommendations that have been made and so on should be treated as issues that are adequate protection issues? Or selectively some of them should go through the cost-benefit analysis before they're implemented and decide whether they should be implemented?

SAID ABDEL-KHALIK: It's a combination, in my view. I'm sorry, again, some are, some aren't.

COMMISSIONER APOSTOLAKIS: Like?

SAID ABDEL-KHALIK: I mean, let's just keep a sort of stand, you know, 20,000 feet up. The big thing that came out is that here's a plant for which the design basis tsunami was inadequate and therefore the first question that

comes to mind is are there other plants for which the design-basis are inadequate and that's the question that we need to answer, defining the design-basis. Now that is not to -- sort of an issue that redefines necessarily adequate protection. It is determining whether the current design-basis is adequate.

Now when you look at something like Recommendation 3, where we're talking about seismically induced fires and floods, that is clearly beyond design-basis recommendation and in my view it is appropriately classified as a Tier 3 recommendation because it would likely depend on the outcome of the modified regulatory structure that is recommended by Recommendation 1 and therefore pending resolution of Recommendation 1, this is appropriately classified as a Tier 3 recommendation and it is clearly beyond design-basis recommendation. I call on my colleagues to add to this response.

COMMISSIONER APOSTOLAKIS: Now, related to Recommendation 1, there have been -- I know the commission has directed the staff to --

SAID ABDEL-KHALIK: Yes, sir.

COMMISSIONER APOSTOLAKIS: Provide some views 18 months later. There are some international people, especially from Europe, who say in public meetings and fora that the major lesson of Fukushima is that we should refocus our attention on Defense-In-Depth and Defense-in-Depth is a cornerstone of reactor safety and we should really focus on Defense-In-Depth. Recommendation 1, as you know, is try to combine risk and Defense-In-Depth. Does the committee have a view?

SAID ABDEL-KHALIK: Well having not reviewed or evaluated that specific recommendation I think my response would be we look forward to the

outcome of your task force.

COMMISSIONER APOSTOLAKIS: Why didn't you evaluate? You're free to do it, I mean --

SAID ABDEL-KHALIK: -- that may morph into the framework for the resolution of the first recommendation but I call on my colleagues to add further comments.

JOHN STETKAR: Everybody looks at me.

[laughter]

I -- no I agree, Said. We discussed internally whether we should address Recommendation 1 and we decided because the Commission explicitly said postpone it -- given the practicalities of everything else that was on our plate regarding Fukushima and trying to be responsive within a reasonable timeframe to those matters, we just haven't had the opportunity to deliberate on that recommendation as a committee.

COMMISSIONER APOSTOLAKIS: Okay.

JOHN STETKAR: That's just the practicalities.

COMMISSIONER APOSTOLAKIS: Now, on slide 34, there -- you address Recommendation 10.2. And I know that Mr. Ray has views on that and you just mention in passing qualifications of decision makers, Harold would you care to tell us about it?

HAROLD RAY: Well, I think that the issue here is as much about who is not qualified to make decisions in severe accident space as it is about what the qualifications are for those who do. This is uncharted territory for regulation, I think, particularly talking about the fate of a large asset who cannot participate or make a severe accident decision. Having been in that position in

exercises, I know it's going to be tough and I think that's why we believe it should get started, that it's important. Certainly agree with Commissioner Svinicki's highlighting that, too. It's not going to be easy to decide how to make sure you have qualified people available and that others, who are not qualified don't assume the responsibility inappropriately.

COMMISSIONER APOSTOLAKIS: But right now don't we have -- I mean it's the operators that are in charge, aren't they?

HAROLD RAY: Well, when you get into severe accident management, the -- I will tell you that it may well be that our lawyers would tell us it's very clear, but in the field when the executives are in the emergency operations facility, for example, and you hypothesize that you're now beyond the emergency operating procedures and who's going to make a decision about what, it's not that clear and I think 10.2 was an appropriate recommendation, personally, and the committee included it as one that should get started right away, because it's going to take time to sort out. Making sure you have people available to do what needs to be done under any circumstances will not be easy.

COMMISSIONER APOSTOLAKIS: Thank you and on Slide 31, the committee comes back to something that we thought had been settled. Licensing actions requiring CAP credit should be suspended. Mr. Shack has been quiet, when you say suspended, what do you mean? Should we go back and take back the credit we have granted?

WILLIAM SHACK: No, I think the committee was referring to new actions.

COMMISSIONER APOSTOLAKIS: And would that be a major contributor to regulatory stability?

WILLIAM SHACK: A contributor to it?

COMMISSIONER APOSTOLAKIS: Well, I mean we have already approved several and now you're saying for the future stop. But is it a safety issue or it's not?

WILLIAM SHACK: The committee has always argued it's a Defense-In-Depth issue.

COMMISSIONER APOSTOLAKIS: [affirmative]

WILLIAM SHACK: And I don't think that we've changed our point of view on that. You brought up Defense-In-Depth before, I think one of the things that we're going to have to do, both in terms of CAP, in terms of station blackout is to look harder. You really do have to address Recommendation 1 and Defense-in-Depth. I mean, I look at -- I look at this question of the performance-based versus the deterministic approach to station blackout as perhaps a Defense-In-Depth issue versus a risk-informed issue and CAP has always been a Defense-In-Depth issue from the committee's point of view and the decisions we make about Defense-In-Depth could well affect the decisions we make about CAP.

COMMISSIONER APOSTOLAKIS: But, I guess the question is -- well leave aside the issue of stability, but the committee argues in the letter that the operators seem to have difficulty controlling the pressure, therefore we should deny CAP credit. Is that a little bit of a big jump?

SAID ABDEL-KHALIK : Not quite. That's not all we say.

COMMISSIONER APOSTOLAKIS: Well you say more. Yeah, go ahead.

SAID ABDEL-KHALIK: We say a lot more. We say that the

operators had difficulty controlling pressure and that in all likelihood, as a result of that, the follow-up actions, meaning, you know, procedural guidance that the operators will in the future have, with regard to controlling containment pressure, the timing, et cetera, will in all likelihood change and until we understand these changes, we're saying we should sort of hold off on granting containment accident pressure. We understand that we have traveled that road before and we also understand and honor the fact that ACRS makes recommendations and the Commission makes decisions. Nevertheless, we believe it is our obligation to bring to your attention a situation of this type, where you may want to reconsider an earlier decision.

COMMISSIONER APOSTOLAKIS: Can I pursue -- how long will it take for us to understand what you mentioned about the operators and so on, is it a matter of a year, is it a long time or -- you said that this difficulty -- yeah, how long are we talking about --

SAID ABDEL-KHALIK: It really is primarily tied to procedural guidance that will come out of the integration of -- that comes out of Recommendation 8.

COMMISSIONER APOSTOLAKIS: And that will take roughly -- I mean we're hoping to finish everything in five years, but this presumably will be done before then?

SAID ABDEL-KHALIK: It is possible that we would have procedural guidance before that.

WILLIAM SHACK: I mean, Tier 1 activities is to look at the venting and I think that, you know, that's the thing that's most closely associated with that. I think everybody believes that there will be an increased emphasis on early

venting come out of the Fukushima and that kind of action will be taken reasonably quickly as people look at the venting and make decisions. So I think, you know, it's less than five years, it's one of the higher priority items. I think you'll have a better understanding of how people will be dealing with that issue and how it could possibly affect the control of CAP under other conditions.

COMMISSIONER APOSTOLAKIS: And what would be the frequency of the vent that would require these?

SAID ABDEL-KHALIK: That would require what?

COMMISSIONER APOSTOLAKIS: Containment pressure.

SAID ABDEL-KHALIK: Well currently they are required for design basis events.

COMMISSIONER APOSTOLAKIS: Well, but that's a legal thing. I mean, the frequency of the vent that would require CAP. I mean, it's supposed to be a LOCA isn't it?

SAID ABDEL-KHALIK: Yeah, but --

WILLIAM SHACK: We don't know that. That's one question we've always been asking and we don't know it. The computed raw that we've been given for containment accident pressure is 750. That's a conservative estimate, but if you don't have containment accident pressure when you need it, the current estimate from your PRAs is that your CDF will go up by a factor of 750. One of the things that we asked for was a more realistic assessment of that. How much it would affect Defense-In-Depth.

JOHN STETKAR: They're not only LOCAs though; remember there are many, many transients that the operators are now expected to actively be in. Welling water reactors actively initiate automatic depressurization. If they

don't have high-pressure injection that gets you into similar situation, for example.

CHAIRMAN JACZKO: Commissioner Magwood?

COMMISSIONER MAGWOOD: Appreciate Commissioner Apostolakis exploring the CAP issue with you -- I was going to do that and I think he did it more elegantly than I would have. Well, perhaps let me start off by recognizing again Said's contributions. Obviously Said was the first chairman, the only chairman of the -- well, present company excepted -- chairman of the ACRS that I had the opportunity to work with, and so you have of course provide the model that I expect others to follow, and that's a very, very difficult model to follow. Your professionalism, your calmness, your attention to detail has been greatly appreciated by me and I'm sure by others. And, you know, as you rotate off I'm sure we'll have plenty of opportunity to talk to you, so it's not -- this isn't a funeral.

[laughter]

SAID ABDEL-KHALIK: I hope not today.

COMMISSIONER MAGWOOD: [laughs]. But your tenure as chairman has been exemplary, especially given the very, very difficult circumstances associated with the large workload the committees had to deal with over the last year and a half and of course the Fukushima incident. So I congratulate you on your tenure.

SAID ABDEL-KHALIK: Thank you, sir.

COMMISSIONER MAGWOOD: Thank you very sincerely. Starting off with Fukushima, I want to ask more of a philosophical question, because this is actually a philosophical debate that we've had on the Commission and I've had

with others as well, and that is exactly what should NRC be thinking about in terms of response to Fukushima. And let me explain what I mean.

There's one way of looking at it, which is that Fukushima presents broad insights that we can apply. We can reconsider things that we've -- decisions we've made in the past and look at things through a slightly different lens. There's others who say that we should look at the specific details of what happened at Fukushima and make our decisions about what changes to make to regulatory structures based on what we actually observed, as opposed to what have thought of after seeing things occur. Was there a debate like that on the ACRS as you went through this?

SAID ABDEL-KHALIK: Yes, but, you know, to me it's very easy for people to get lost in the details and miss the big picture. And I would say that the Near-Term Task Force report appropriately focused on the big picture, the things that became self-evident to these informed individuals as a result of this event rather than getting lost in the details. So, I'm of the first group, which is, you know, that's why we say explicitly that none of the recommendations will be negated or rendered inappropriate by the acquisition of additional information from Fukushima, because these are big picture issues that became apparent rather than sort of nitty gritty details of, you know, why this particular system failed or why we lost this particular instrument or et cetera.

COMMISSIONER MAGWOOD: Appreciate that. I think that sort of represents the other point of view for a moment. I think, as I've talked to people, that one of the concerns is that if you detach NRC's response from the realities of what actually occurred at Fukushima, you have the risk of well basically regulatory instability. Of reconsidering things just because it seems like a good

idea or because it feels right, as opposed to linking it to specific events. Is that -- I'm just curious as to whether this was a big philosophical discussion on the Commission or in the committee, or was this something that was really not --

SAID ABDEL-KHALIK: It wasn't. And that's why, you know, I can give you a personal sort of caution. That as we sort of parse and divide and prioritize the Near-Term Task Force recommendations, we should make sure that the original intent of these recommendations is indeed fulfilled, because there is a tendency, as we go through the process, to sort of redefine those recommendations when you look at them in smaller pieces rather than the full scope of the recommendations. That would be my biggest concern.

And to give you a specific example, Recommendation 2.3. If you look at the original wording in the NTTF report on Recommendation 2.3 regarding lockdowns, really the bottom line is you're trying to see whether any interim compensatory measures that people will take as a result of the redefinition or a reevaluation of these external events will be adequate until the actual modifications are made; and now that sort of has morphed a little bit, in the sense that you can read them. You can read the definition of the actions as calling for people to verify the current design basis. And I'm sure you would agree that if Fukushima Daiichi had done that, verified current design basis on March 10th, they would have passed with flying colors. So, the point is, we just need to be true to the original intent of these recommendations.

COMMISSIONER MAGWOOD: In that context, let me ask you about one specific recommendation that the committee made, and that's with regard to the spent-fuel pool instrumentation.

SAID ABDEL-KHALIK: Yes, sir.

COMMISSIONER MAGWOOD: Where you had indicated that we should reconsider the staff recommendation, which in ACRS parlance is a pretty strong term.

[laughter]

COMMISSIONER MAGWOOD: And I want to explore that a bit, because that runs a little counter to what you just said in a way, because I think that certainly while we've found that the spent-fuel pools were not a major contributor to, you know, the impact on the environment and public health, the fact of the matter was there was a lot of questions about what in the world was going on in the spent-fuel pools. There's still questions about it because we don't have enough data.

SAID ABDEL-KHALIK: Right.

COMMISSIONER MAGWOOD: And as I've visited nuclear power plants since Fukushima, I've been in the habit of asking the question, "How do you know what the level of your pools are?" And some companies have some way of measuring, sometimes there's a very rudimentary video cameras focused on a yardstick sitting in the pool and that's -- it works. Others have more sophisticated but most don't have any way of knowing. They have level indicators. It goes below a certain point they get an indication. So, when I -- as I engaged this, I was thinking about this in terms of, "Wouldn't it be a good thing to know what your pool levels were." And then you can have the conversation, "Is this safety grade or is this commercial grade." You can have that conversation and that's a fine conversation to have. But is -- I get the impression from reading the recommendation that ACRS just doesn't think this is a big deal.

SAID ABDEL-KHALIK: Well, there was a lot of debate, as you

might imagine, before we finally settled on Recommendation 5 of our second letter. What we're saying is that we're not objecting to the staff going out and collecting information regarding instrumentation, et cetera. In fact, we say, "You ought to collect more information about, you know, power supplies, the sources of water for makeup and cooling, et cetera" as we say in our first recommendation. I think what got, and sort of stuck in people's throat, are the words, "Issue orders once you collect the information," rather than, "Issue orders as appropriate."

So the two recommendations in our first letter versus the one in the second letter may seem to be slightly inconsistent, but they really aren't. We're sort of in fact agree with the staff, and we also recognize that many licensees have already started looking at this issue in terms of what instrumentation you need and in fact some of them have already modified their emergency operating procedures to point the operators attention to the state of the spent-fuel pools.

COMMISSIONER MAGWOOD: Okay, and tell John were you -- okay. It's amazing how quickly that time went by [laughs]. Let me just sort of mention John and Mike. I appreciate both your presentations. I agree with most of what both of you had to say and did have questions for you, but Said talked too long.

[laughter]

JOHN STETKAR: That's why he's here.

[laughter]

SAID ABDEL-KHALIK: That's why I'm being kicked out.

[laughter]

COMMISSIONER MAGWOOD: Well, again, thank all of you for

your fantastic work and for your presentations today and look forward to continue our work together. Thank you.

CHAIRMAN JACZKO: Well, I just had a couple of questions. One, I wanted to go back to the issue of prioritization of the prioritizations, if you will. When I think about the need to prioritize, it's generally because you have a constraint somewhere, otherwise you don't need to prioritize. So, as I understand what the staff did with the Tier 1 issues is they looked at all of those things that could be done without any constraints. So, I think you indicated in your response to the question of Commissioner Svinicki that we should reexamine, you know, the Tier 1 issues and reprioritize within those. And if so, what do you think -- what's the constraint that's driving a need to do that.

SAID ABDEL-KHALIK: I didn't say that we should go back and reexamine that, I said that there's clearly, you know, within that big classification of Tier 1 there are some recommendations that will have greater impact than others. There are some recommendations that have, sort of, that there is -- for which there is a need for greater immediacy than others.

CHAIRMAN JACZKO: Okay.

SAID ABDEL-KHALIK: You know, I believe that the methodology and the criteria used by the staff, the three tier recommendation, is sort of philosophically consistent. And I'm not saying we should go back and redo it.

CHAIRMAN JACZKO: Well, and I guess I'm not suggesting redoing the tiers, but I guess it's whether we go through and try and define within that Tier 1 what are the higher and lower priorities or let them go and work and get done what they can get done.

SAID ABDEL-KHALIK: At the risk of being impertinent, Fukushima

happened eight and a half months ago. And with all due respect, all we've been doing is talk. Sure, it's pretty sesquipedalian persiflage but it's still talk. So, my feeling is we should get on with it.

CHAIRMAN JACZKO: Thanks. On this issue of getting on with it, which I agree with you 100 percent, and I agree very much with the committee's intent to accelerate the station blackout rule and the Commission and the SRM on the 21 day did encourage hitting 24 to 30 months for completion of the station blackout rule. And the Commission also indicated an ANPR and you've also indicated an ANPR. In the spirit of getting on with it, how will an ANPR help us get on with that rule in a way that meetings and then a proposed rule wouldn't better get us on with it?

SAID ABDEL-KHALIK: Well, I mean, you know, you're coupling the two recommendations.

CHAIRMAN JACZKO: Right.

SAID ABDEL-KHALIK: Our first recommendation was based on the fact that, you know, looking at the 21-day report, there was no indication that there would be an issuance of an advance notice of proposed rulemaking and we noted that , "this is missing. You got to do that."

CHAIRMAN JACZKO: Well we don't have to do it. I mean, if that was a process issue, I mean it's something the Commission has essentially gotten away with, or gotten away from, because it's not found to be conducive to kind of efficient rulemaking.

SAID ABDEL-KHALIK: I mean, our second -- I mean, we're not schedulers.

CHAIRMAN JACZKO: Yeah.

SAID ABDEL-KHALIK: Right? We're technical experts.

CHAIRMAN JACZKO: Right.

SAID ABDEL-KHALIK: And we're saying, "Hey, this is way too important" --

CHAIRMAN JACZKO: Yeah.

SAID ABDEL-KHALIK: -- "to wait for 4.25 years plus X number of years." The American public demands better than this. That's all we're saying.

CHAIRMAN JACZKO: Okay, thanks. Well, I think that's helpful, because my personal belief is that we're better off getting some -- doing some meetings, getting people talking, get a draft rule together, put that out for the formal comment. I mean, two years is an aggressive time table but I think it's a doable one on this issue and as you stress, I think the importance of it is there.

I think that's all I have on Fukushima for now. Mike I wanted to turn to you. A couple of questions on your presentation and I think it's certainly an interesting presentation and I don't think -- I mean, this is not I think a new position the committee has taken with regard to Part 61. I know we've had lots of meetings in the past where either ACNW or now ACRS I think has indicated an interest in risk-informing Part 61.

The Commission actively I think chose to go forward with a specific rule right now that looks narrowly at the DU and the blending and kind of the special, unique waste streams issue and in that context, putting aside I think the longer term efforts to look at risk-informing, in that context of trying to get some rules of the game out there because people are looking to dispose of this material now, are there things in the staff's proposal that you think have merit? I mean in particular for DU we may be looking at, you know, a need for more of a

nontraditional radionuclide in the sense that the hazard tends to build over time, as opposed to the traditional approach which is we've got decay and eventually get daughter products that tend to have less hazard. But with DU we may have the opposite effect with certain longer-lived radionuclides building in. Radon in particular I think presenting a bit of a challenge. Is there some value in what the staff is saying in this interim period to pick a performance date and go that? What are your thoughts on that, or anybody actually for that matter?

MICHAEL RYAN: Thank you, I think that's a central question and I think the reason the committee's letter was strong on that point is the answer is it's counterproductive because 10,000 years and 20,000 years for uranium and radon building from uranium is exactly the same. There's no difference. It makes near surface description much more difficult. So it's a step backwards for no step forward, you know, in the performance assessment scheme. So, I think that the recommendation to risk-inform it as a system and focus on the metric of fractional release from an inventory, with all of its glory being considered in terms of waste form packaging and all the rest, is the appropriate step to take at this point. Now, it may be to start that process and begin it, but it really doesn't solve the problem, you know, that low-level waste is really based on bounding calculations that were designed in the 1960s instead of a risk-informed, more sophisticated approach that we can easily do today.

CHAIRMAN JACZKO: So what would you do with the sites that are out there and the material that's currently of interest to be disposed, in particular the DU? Would you want a moratorium on that disposal until we get the risk-informed rule done or how would you -- what would you tell the state of Utah that is moving forward with a performance assessment now to deal with DU?

MICHAEL RYAN: Well, whether it's Utah, South Carolina or Texas or any of the other states, I think the answer's going to be basically the same from my perspective. And that is that DU being disposed is of interest from two points of view. We have, "What is the fractional release from that inventory over time once disposed?" That's a fairly straightforward calculation and typically shows results that are well within a performance assessment. It's only when we sprinkle the intruder in, where the probability of intrusion is one, the probability of conducting your entire life through the disposed waste is one, and it doesn't really make any sense. There are lots of alternatives to assuming the probability of intrusion is one and the scenario maximizes exposure to the individual. Depth of burial, waste form, some of the other things we've talked about.

CHAIRMAN JACZKO: Those are not trivial things to impose on an existing disposal site. I mean, we're talking, realistically to come up with those things, years. I mean --

MICHAEL RYAN: Yes, absolutely.

CHAIRMAN JACZKO: So the issue, and I think where the Commission has been in the past, is that we have an immediate interest to dispose of this material. So, given that we have an existing system of sites and it's not clear to me, while there may be preferences to risk-inform, it's not clear to me that risk-informing solves a particular problem that we have with any waste disposal sites right now. I mean, if you dealt with DU and you dealt with the blending, what issues would be out there that risk-informing would solve for you?

MICHAEL RYAN: I think it would create a framework for a better analysis for issues that have been traditionally done by bounding calculations.

CHAIRMAN JACZKO: Would you advocate then -- I mean let's say

if the solution to some of this -- if what we do is move away from intruder probability of one and when somebody tells me how they're calculating the intruder probability then we can assign a probability to it. But if you get to, you know, some approach like that where you're dealing with the intruders there by going to deeper burial, does that mean that existing waste then is dug up and put at a deeper depth or it's just new waste being put into the site? How do you handle -- I mean, you've got these existing sites that are out there.

MICHAEL RYAN: Well, two things work in your favor to kind of minimize the impact of having a shift in gears, if you will, for that assessment. One is radioactive decay. Two-thirds of the inventory in the site I'm most familiar with, Barnwell, is cobalt-60. Two-thirds of the radioactivity. Seven percent is nickel-63 and on down, so the vast majority of the waste decays away in the 100-year institutional control period. You're literally dealing with five radionuclides that remain. The main one is uranium. So we very quickly get to the point where it's an issue just like the one we've described the solution for. So, I think, in addition to that --

CHAIRMAN JACZKO: And again, that's I think very much in a way where the Commission was, which is, "Let's solve these unique waste streams, because if we solve these unique waste streams, the system basically works and is conservative and protective of public health and safety for everything else that's out there." And as you indicate, I mean, we've got this inventory and not much is happening with and the facilities will be set. So -- which brings me back to -- you know, and I support it. I mean, I think in the past I did indicate support for just doing this all at once but we're pretty far down the line now and I think, you know, we have an approach that is protective of public health and safety. I'm

not so sure why we would stop that at this point.

MICHAEL RYAN: Well I think the trouble for me is my own personal opinion is the 20,000 years is an intractable amount of time to describe anything with a high enough degree of certainty, or a lack of uncertainty, that you can convince anybody you really know what's going to happen. If it's a deeper disposal, certainly you can get there. Does it need to be, you know, based on amount? Quantity? You know, and it's quantity disposed that really determines the risk, not the concentration --

CHAIRMAN JACZKO: All right, but that's a philosophical change from being driven by the intruder scenario versus a non-intruder scenario.

MICHAEL RYAN: Absolutely, you know, I mean --

CHAIRMAN JACZKO: Which, I mean, is again -- I mean, that's part of the underlying basis here. Which, while it's a different approach, not necessarily risk-informed, it's a different philosophical approach to the dominant hazard -

MICHAEL RYAN: It really is a barrier to being risk-informed, because it puts emphasis on the wrong metrics for the material being managed. That's my view of it.

CHAIRMAN JACZKO: Yeah. And no, I appreciate that and it's not necessarily I think one that is without debate. But -- well again, I appreciate your answers and the committee's thoughtfulness on this. And I'm way over my time, so -- but I want to thank everybody for their presentations and look forward to hearing more from you all as we go forward.

SAID ABDEL-KHALIK: Thank you very much.

CHAIRMAN JACZKO: And Said thank you for your service as

Chairman.

SAID ABDEL-KHALIK: Thank you very much, sir. Happy holidays.

[Whereupon, the proceedings were concluded]