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MEETING WITH ACRS

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TRANSCRIPT OF PROCEEDINGS

Public Meeting

Before the U.S. Nuclear Regulatory Commission:

Allison M. Macfarlane, Chairman

Kristine L. Svinicki, Commissioner

George Apostolakis, Commissioner

William D. Magwood, IV, Commissioner

William C. Ostendorff, Commissioner

APPEARANCES

ACRS Members:

Dr. Sam Armijo
Chairman

Mr. John W. Stetkar
Vice Chairman

Mr. Charles H. Brown, Jr.

Dr. William J. Shack

Dr. Dennis C. Bley

Dr. Michael T. Ryan

P R O C E E D I N G S

CHAIRMAN MACFARLANE: Good morning, all the rest of you. Come on up, please.

All right. So today the Commission is going to be briefed by the Advisory Committee on Reactor Safeguards. Recognizing that today's briefers are a subset of the Committee, I'd like to thank all the ACRS committee members for their service. The Commission really highly values their advice that the committee provides to us on the important issues that are before us. The members, of course, bring an impressive array of knowledge and experience, which they bring to bear on their views on these topics that we discuss. I'd like to welcome back former ACRS member and ACRS chairman, Dr. Mario Bonaca, who I understand is joining us today.

EDWIN HACKETT: Unfortunately, Chairman, it doesn't look like Dr. Bonaca --

CHAIRMAN MACFARLANE: He's here? Okay.

EDWIN HACKETT: -- will be able to make it this morning. He will be here later.

CHAIRMAN MACFARLANE: All right. And do we have our new members here?

EDWIN HACKETT: Yes, we do.

CHAIRMAN MACFARLANE: So I'd like to welcome the newly selected members of the ACRS, Dr. Pete Ricciardelli and Dr. Ron Ballinger, who will be joining the committee later this year. What?

[laughter]

CHAIRMAN MACFARLANE: Raise your hands.

[laughter]

CHAIRMAN MACFARLANE: Are you Pete --

PETE RICCIARDELLI: I'm Pete.

CHAIRMAN MACFARLANE: and Ron

RON BALLINGER: Yeah.

[laughter]

CHAIRMAN MACFARLANE: Thanks. I'm sure the Commission will be very well served by your knowledge and experience in the area of nuclear materials. Today we're going to begin things with Dr. Sam Armijo, the ACRS chairman, providing an overview of the activities of the committee since our last meeting with the ACRS, which was in December, 2012. That will be followed by a discussion of Chapter 7 of the Design Specific Review Standard for the In-Power Instrumentation and Control Systems by Mr. Charles H. Brown. Next we'll hear from Dr. William Shack on the station blackout mitigating strategies rulemaking. And that will be followed by Dr. Dennis Bley --

DENNIS BLEY: Bley is right, thanks.

CHAIRMAN MACFARLANE: -- discussing the committee's review of key licensing issues associated with the Next Generation Nuclear Plant Program. Dr. Michael Ryan will then brief us on draft NUREG-2125, Spent Fuel Transportation Risk Assessment. And finally, we'll be briefed by the ACRS vice chairman, Mr. John Stetkar, on draft NUREG-1855, Revision One, on the topic of the treatment of uncertainties associated with PRAs in risk-informed decision-making. So I look forward to your thoughts on all these topics and to thought-provoking discussion with the Commissioners. First, let me see if any of my fellow Commissioners would like to make remarks?

COMMISSIONER MAGWOOD: Just very briefly, Chairman. First, Dr. Shack's going to be -- I know you are going to retirement, but let me just note that your work -- while we talk about your work at ACRS, I think the work you did at Argonne National Laboratory also was very impressive. I remember when you -- when we first met I read your bio and hadn't realized how many things you'd been involved in, so, you know, congratulations on not just your participation in ACRS, but a very long and very distinguished career. And also, Chairman, I wanted to give a special welcome to our special guests from Taiwan, our regulatory colleagues who are just going to join us for a little while this morning, who are just observing the Commission at work. And I'm going to be traveling with them to Surry Nuclear Power Plant tomorrow, so I'm looking forward to that. But I'm glad they had a chance to just take a quick look to see how we do business here in the U.S. Thank you, Chairman.

CHAIRMAN MACFARLANE: Great. Anyone else? No? Okay, all right, then I'll turn it over to you, Dr. Armijo.

SAM ARMIJO: Thank you, Chairman. First chart -- I hope we have the first chart. Okay, here we are. Since our last meeting with the Commission on December 6 of 2012, we have issued 16 reports, a variety of topics. The first one would be the draft Design-Specific Review Standard for mPower, IPWR Chapter 7, Instrumentation and Control Systems. And Mr. Brown will provide a more detailed briefing later this morning. Next chart.

The Station Blackout Mitigation Strategies Rulemaking which Dr. Shack will present shortly. Next Generation Nuclear Plant Key Licensing Issues, Dr. Bley will present that. And draft NUREG-2125, Spent Fuel Transportation Risk Assessment, which will be presented by Dr. Ryan. We've reviewed the

Construction Reactor Oversight Process Program and Private Program Results. Next chart.

Draft Revision One to NUREG-1855, Guidance on the Treatment of Uncertainties Associated with PRAs and Risk-Informed Decision-Making, which Mr. Stetkar will present. Reviewed technical information needs affecting potential regulation of extended storage and transportation of spent nuclear fuel and selected chapters of the Safety Evaluation -- next chart -- selected chapters of the Safety Evaluation Report with open items for the US-APWR design certification and safety evaluations of supporting technical reports. We've reviewed selected chapters of the Safety Evaluation Report with open items for the Comanche Peak Nuclear Power Plant, Units 3 and 4, US-APWR Reference Combined License Application. Next chart.

We've also reviewed W-CAP 17116-P, the Westinghouse BWR ECCS evaluation model supplement five, for application to the ABWR. Also, the report on the safety aspects of the license renewal application for the Limerick Generating Station. Next chart.

Our reviews included a number of regulatory guides, including Revision One to Regulatory Guide 1.163, Performance-Based Containment Leak Test Program, Regulatory Guide 4.22, Decommissioning Planning During Operations, Regulatory Guides 1.168 and 1.173, Software Processes for Digital Computers and Safety Systems of Nuclear Power Plants. Next chart.

Ongoing and future reviews address a number of topics. In the new plant area, we're reviewing design certification applications and safety evaluation reports associated with the EPR and the US-APWR designs, the adequacy of long term core cooling approaches for the US-APWR and EPR,

reference combined license applications for the ABWR, ESBWR, US-APWR, and EPR, and subsequent combined license applications for the AP-1000. Next chart.

In the area of license renewal, we are reviewing interim and -- performing interim and final reviews for Grand Gulf, South Texas, Callaway, and Sequoyah, and final reviews for Diablo Canyon, Seabrook, and Davis Besse. In the area of extended power upgrades, we will be reviewing Brown's Ferry 1, 2, and 3; Peach Bottom 2 and 3; and Monticello. Next chart.

In the -- what we call other category, a long list of different topics. In fact, this week we are working on the Spent Fuel Pool Study revisions to 10 CFR Part 61 and uncertainties in the SORCA analysis. We also will be reviewing in the near term Fukushima longer term efforts, for example, the Recommendation 1, the Station Blackout Rule, and Tier Three recommendations. We will, of course, review Watts Bar 2, fire modeling applications and complete our review of the Naval reactors Gerald Ford Class power plant. At this point I'd like to turn the briefing over to Mr. Charles Brown.

CHARLES BROWN: This brief on the draft Design-Specific Review Standard for Empire, IPR Chapter 7 Instrumentation and Control Systems is going to consist of two parts. The first few slides will provide some basic fundamentals and characteristics of reliable instrumentation and control systems. The second set of slides will provide a high level view of how these principles are embodied in the mPower Small Modular Reactor Chapter 7 Design-Specific Review Standard. Next slide.

Nuclear power plant safety system designs rely on the following fundamental principles plus one, to compensate for failures that could degrade

safety system reliability. Those principles are redundancy, independence, determinacy, defense in depth, and diversity, plus a somewhat subjective principle of simplicity. These principles apply to computer platform-based software-based digital instrumentation and control systems, as well as analog-based systems. Today nuclear power plants are being designed with computer-based digital instrumentation and control systems and networks as the backbone for protection, control, alarm, display, and monitoring. Next slide.

Computer-based systems allow for enhanced performance, but they do result in a much higher degree of functional integration and have new design and failure issues. For example, they are inherently -- they have less inherent inter-division communication independence, non-inherently deterministic processing, software complexity, and extensive verification and validation processes. Next slide.

Also, networks are now used for communication between plant systems and control spaces and to external site and corporate networks, resulting in potential compromised control of access from external plant networks. Next slide.

Thus, the use of computer-based systems need new design features that ensure the fundamental principles are embodied and captured in the digital instrumentation and control architecture, particularly, independence. That one way, non-software-based hardware for data transmission to external networks is part of the basic digital instrumentation and control architecture. And very importantly, both of these features are detailed during the licensing and design phase. Next slide.

The Office of New Reactors has begun to develop design-specific

review standards for small, modular, integral PWR designs starting with mPower to streamline and improve review quality and efficiency. Next slide.

Licensing reviews of digital-based I&C systems have been a significant challenge. Industry has consistently expressed licensing certainty of I&C to be one of their highest priorities for new reactors. The DSRS Chapter 7 goal is to apply lessons from recent reviews of digital instrumentation and control systems and develop a review standard for the mPower small modular reactor design that enhances the focus. Let me emphasize that, that enhances the focus on fundamental safety principles. The DSRS reorganizes the existing standard review plan from a bottom-up system-by-system approach where regulatory requirements and principles are repeated multiple times to a top-down approach, which focuses on ensuring the basic architecture of the DI&C systems, meets the fundamental design principles, provides guidance on those fundamental design principles, and then, assesses the design characteristics and regulatory requirements within each system. Next slide.

The committee reviewed the Empire Chapter 7 DSRS at our December 2012, meeting and had the following comments and recommendations. The control of access section of the DSRS should be revised to ensure non-software-based one-way external communication as part of the basic hardware architecture. With the above exception, the DSRS Chapter 7 is a significant and innovative approach to revising the standard review plan for future instrumentation and control designs. Next slide.

Although an mPower pilot initiative, the DSRS is likely applicable to large reactor designs, as well as to other small modular reactors. We are working with staff to resolve our recommendations. That completes my brief.

WILLIAM SHACK: I'd like to discuss the ACRS review of the staff's work on a new Station Blackout Rule. We've had subcommittee meetings on this in December and April, and we've completed our review of their work on the mitigation strategies rulemaking in June 2013. Just a little background. Next slide please. Station blackout involves the loss of all off-site and on-site AC power. Again, typically DC power is assumed to be available and inverters are available for that. The current Station Blackout Rule, 10 CFR 50.63, which was promulgated in 1988, requires that all plants be able to cope and recover from station blackout. It's intended primarily to address relatively short term SBOs due to weather and grid disruptions and, again, plants are required to demonstrate an ability to cope over a relatively short time, typically four to eight hours. Now, studies have indicated that this rule has been successful. It's been long recognized that station blackout sequences are an important accident sequence for light water reactor plants and are large contributors to risk. The Station Blackout Rule provided a significant reduction in that risk. However -- next slide, please.

The scope of the current rule is limited basically to focusing on switch-yard, grid, and weather-related events. The external events, for example, fires, flood, and seismic are not specifically addressed by the rule, and, in fact, were essentially, in the supporting NUREG that led to the development of the rule, were considered to be low probability events could be ignored. Much of the -- or many of the plants, about 38 of them, also depend on an alternate AC source that can be credited for coping with station blackout. Next slide, please.

The Fukushima accident demonstrated that there are other aspects of station blackout that need to be considered. We have external events that

could be beyond the design basis, we have extended station blackout conditions that can last not just for hours, but days. There's a potential for impact on multiple units at the same site, frequently not been considered. And the alternate AC power source was not intended to be robust against external events like floods and seismics. And so, it's a potential for failure in such events. We also need to make sure that we provide spent fuel pool cooling during extended SBO, could last for an indefinite amount of time. And, again, station blackouts can occur not only at full power, but during any mode of operations. Now, the Commission has taken action in response to the NTTF task force to address these things through the Order EA-12049, the Mitigating Systems Order, which essentially requires plants to be able to provide core cooling and spent fuel pool cooling for an extended indefinite period of time. Next slide.

Again, in response to the -- essentially the near term task force, which recommended a revision of the Station Blackout Rule and essentially the staff's direct -- or the Commission's direction, the staff has now issued a call for a revision to the Station Blackout Rule. The proposed approach, of course, is going to be consistent with the order and, in fact, in many ways can be considered as making it generic and a permanent part of the regulations. There's no question that this provides a significant increase in depth beyond the current SBO rule because of the way it addresses extended blackouts and focuses on external events. And we think it addresses limitations in the current rule. Next slide.

This background and the order, I think, provides sufficient regulatory basis for the mitigation strategy rulemaking. One important question that's not allowed in the current mitigation strategies order is this credit for

supplemental AC power source that you were explicitly not able to credit it in the order. The question is whether that should be credited in a new station blackout rule. This would be a different kind of power source. It would be a robust source that was designed to deal with external events, perhaps even beyond-design-basis external events. It has strong industry support and it's attractive because it provides greatly increased capability over that you could normally expect to find from many types of portable equipment. We think it should be explored further. There are always tradeoffs between the increased capability we get from something like the power source versus the flexibility that you get from portable equipment with multiple modes of being deployed. And, again, since we're not dealing with any fixed strategy, that flexibility could be advantageous.

One of the shortcomings we see in the current order, and we hope to be fixed in the rule, is to be more guidance on evaluating the feasibility and reliability of manual actions. Again, for the portable equipment, you have to be able to move it, you have to be able to hook it up. We're in challenging conditions by and large, you know, this is not a normal proceduralized action. And, again, this is not formal HRA analysis, you know, because we don't have a defined scenario to look at. But we think there's certainly guidance for doing this if we look at the guidance that's been developed for manual actions in response to fire, which again involves manual actions under challenging conditions and there are ways to essentially assess that feasibility and reliability of the manual actions. And we think that should be, again, not in the rule, but part of the guidance for the rule, and it's really not being addressed in the current guidance provided for the mitigating order by NEI-1206. Next slide, please.

Another area that we were concerned about, and again, we're

undertaking new evaluations of the risks associated with seismic and flooding at the plants, the external ones. And we think that the staff should consider the results from these ongoing assessments to determine if their available margins for these hazards are adequate for the development of mitigating strategies. And part of the thought is that we talk about being for beyond-design-basis, but again, since that has an unlimited kind of range, as a practical matter what's happened is that we asked for protection against design-basis accidents, we asked for equipment that's robust against design-basis accidents. And in seismic terms, we know that we have margin. The code provides margin. We explicitly call for that margin for new plants with seismic design. But we know the old plants have it and much of the equipment obviously has recognized capabilities beyond that. So, there's a margin there that we understand for the seismic one. We don't understand this as well, I believe, for the design-basis flooding and what kind of margins may be available under certain situations there. And all we're asking is that they reflect on the results that come from the new flooding studies to see if, in fact, the design-basis requirements provide the margin that we're looking for in the mitigating systems where we're sort of asking for some capability beyond that design-basis.

One other consideration that we didn't specifically address in our letter is whether we should now have essentially three rules that deal with station blackout, 50.63, which is the current rule and can be considered as sort of the more frequently-occurring but less severe station blackout kind of events. The mitigating systems order, which deals with the extended or beyond-design-basis events, and then the 50.54(h)(h)(2), which, again, assumes that you had some sort of catastrophic thing that has involved large damage to the plant. And so,

there are three tiers of availability here and industry comments, again, part of the old rulemaking, the staff asked whether we should maintain the current rule and industry, I guess, AREVA was the only one that even sort of contemplated the possibility that there might be some efficiencies in looking at this in a more integrated way. The ACRS discussed it because we couldn't come to a consensus. We just looked at that as, again, something that still needed to be considered and, you know, we'd be open to possibility that there could be some efficiencies in a more unified approach. Next slide, please.

Now, in addition to the loss of AC power, there's also the possibility that your other usual means of decay heat removal could be lost. That's really not considered as a separate condition in the mitigating systems order or in this new work for the thing. You know, we've somewhat addressed that in the development of the hardened containment vent for BWRs, which gives an alternative way for heat removal by exhaustion through there. And, you know, some plants have other means through feed and bleed, some plants don't have feed and bleed capability and so, there's the possibility of whether it's worthwhile looking at essentially some additional requirements to assure a robust decay heat capability for beyond-design-basis things. We think that that -- those measures are likely to be highly plant-specific and difficult to address in a generic way. But there's something we think perhaps should be considered as part of the staff efforts on NTTF Recommendation 1 for defense in depth or the risk management task force program development where, again, you look, and perhaps in a more plant-specific kind of vulnerability way and consider some things there. And that completes my presentation.

DENNIS BLEY: Thank you. Good morning. This story on NGNP

goes back a way, and I think one might say it begins in the early 2000s with DOE's program that got everybody looking at new reactors. Gen-4 Roadmap came out in 2002. In 2005 -- next slide -- NRC joined the action because the Energy Policy Act of 2005 directed DOE to establish the NGNP project and stipulated that NRC has regulatory and licensing authority for that project. Next slide.

DOE selected the high-temperature gas cooled reactor as the NGNP technology early in that process. And in 2008, DOE and the Commission jointly submitted the NGNP licensing strategy report. That report described four options for licensing. Option one was the kind of deterministic, traditional approach and it went all the way to an option four that would have led to a new body of risk-informed, performance-based regulations. The two bodies endorsed option two, which was titled a risk-informed, performance-based approach. The idea was that engineering judgment and deterministic analyses would be supplemented by information from PRA to develop the licensing basis and the technical requirements. The options three and four push more and more to the side of using the PRA as the PRA's quality and completeness has increased. Next slide.

In the option two that led to our review of the staff's evaluation of the DOE submittals, it's a design-specific -- uses a design-specific PRA to help select the licensing basis events and to guide the special treatment of the system structures and components. The approach would adapt current regulations as necessary to move forward. Next slide.

In the period -- pardon me -- 2009 to 2011, Idaho National Lab for DOE submitted white papers that addressed the key issues that were highlighted

in the joint licensing report. The staff reviewed those white papers and issued draft assessments and a summary report on the licensing issues earlier this year and we reviewed that work. The NGNP approach was seen as generally reasonable with certain caveats, and those caveats were mostly associated with incompleteness in the information about the design. Next slide.

The staff caveats dealt primarily with the lack of detailed design information and incomplete testing, that they felt precluded firm conclusions on some of the issues that were submitted. They also stated that they expected that many of those issues could be resolved during pre-licensing -- pre-application interactions with an applicant as information became available. They also raised the issue that it was not clear that all service conditions during possible accidents had been considered. And this is basically because there's no complete design and there's no PRA of that design to this point. Most of the conclusions or inferences from the risk assessment came from the old MHGTR design from 20, 30 years ago. And finally, they identified that additional fuel testing is necessary, and that work is actually ongoing at Idaho scheduled over the next couple of years. Next slide, please.

The approach to option two, it was laid out in the white papers, was a little further modified through interactions between staff and the DOE and Idaho. The approach that was evaluated then is one that uses design-specific PRA to select the licensing basis events, and that's the anticipated events, the more frequent ones; the design-basis events, the less frequent set; and the beyond-design-basis events, the very rare events. It also defined that there would be a set of design-basis accidents in the tradition of our current licensing approach. Those accidents would be analyzed in much the same way. Only

safety-related systems would be credited in the analysis. It would be detailed deterministic analysis to show that they could survive -- that the plant could survive these events. Next?

The PRA would be used to guide special treatment of SSCs. The treatment would be requirements on that equipment commensurate with the risk associated with that equipment and the kinds of scenarios in which that risk applies. And finally, they felt current regulations could be mostly used with some adaptations and that will take some time to work through. Next slide, please.

We submitted our letter on the staff review of the white papers earlier this year. Our basic conclusion was that the staff assessment of the white papers is appropriate given the unavailability of many design-specific design details, plant-specific design details. We had three recommendations. The first is that the staff assessment documents should be revised to provide clear links to the RAIs and responses. The reason for this is because there's no application. This is kind of an unusual case. We have a set of white papers on some aspects of a design for the future, so we don't have the complete design. Also, DOE and staff agreed with them, decided not to revise those white papers. So, the discussions that led to the final system that the staff reviewed isn't fully documented anywhere since those papers weren't going to be revised. In June of this year, the staff responded to our letter and they agreed to do this. But they pointed out to us that there's more than just the RAIs and the responses. There were a series of public meetings and discussions at those meetings that really almost had more impact on the final system they assessed. So, they're going to revise their document to identify areas where what they looked at differs from what's in the white papers and why. Next slide.

Our second recommendation dealt with the fact that staff licensing basis event selection assessment needs to point out and clarify the definition of what are event sequences, what are families of those sequences, what -- to which of those classes do the frequency limits that divide the anticipated events, the DBs and the design -- the beyond-design-basis events apply. Staff agreed with that, as well. They're going to do that.

Our last recommendation, we felt that staff's position that the final selection of design-basis accidents should include postulated deterministic event sequences is really inconsistent with the rest of the framework that's there. That framework takes all of the events that are considered, runs them, evaluates them in a probabilistic risk assessment and uses those results to help this process. Staff essentially agreed with us and we had a caveat to that in our report. If deterministic looking and engineering judgment suggests some events that aren't there, those events clearly need to be added to the PRA, evaluated and then considered in this process. Finally though, in the end, if some of the events from the PRA, based on these deterministically or judgmentally-added events, don't move up to the level they seem appropriate, then if the staff's judgment is that either the frequency evaluation or the consequence evaluation is not fully worked out, that it would be reasonable to add those events based on engineering judgment. And staff's agreed with that position. They point out they have to, they have to apply judgment. We agreed with that. That's the end of mine. Mike, it's up to you.

MICHAEL RYAN: Thanks. Happy to talk to you this morning about the draft NUREG-2125 on spent fuel transportation risk assessments.

MALE SPEAKER: Okay.

MALE SPEAKER: The building's only falling apart.

[laughter]

MALE SPEAKER: Somebody's coming at me.

[laughter]

MICHAEL RYAN: The staff has conducted and published a series of studies evaluating the risks associated with the transportation of spent fuel casks. In NUREG-2125, the document provides evaluations of risk associated with spent nuclear fuel shipments by rail and highway. The ability of a transportation cask to maintain its structural integrity under mechanical forces and thermal loading conditions is a critical issue for the transportation safety and is important in understanding and quantifying transportation risks. The staff has conducted and published a series of studies evaluating the risks associated with transportation of spent nuclear fuel in casks. Past risk assessments of spent nuclear fuel transportation have used simplified event trees to determine accident conditions and their associated probabilities along with simplified, conservative, structural, and thermal analysis of generic cask designs. In the current study, NUREG-2125, the risk assessment was performed using actually cask designs, state-of-the-art structural and thermal analysis tools and more realistic accident scenarios. I'm sorry, we don't have the slides up. That was slide one.

SAM ARMIJO: We can go back to them, all right?

MICHAEL RYAN: Okay, thank you. In the next slide you can see the pictorial presentation of the transportation cask for spent nuclear fuel is designed to maintain their integrity in severe accidents. Type B packages are designed to pass the sequential series of tests described in 10 CFR 71.73, Hypothetical Accident Conditions. And these tests include a nine-meter drop

onto an essentially unyielding horizontal surface, a one meter drop onto a fixed 15-centimeter diameter steel cylinder to test the cask resistance to punctures, an 800 degree Celsius fire that fully engulfs the cask for 30 minutes, and immersion under .9 meters of water. Next slide, please.

NUREG-2125 presents results from studies of radiological impacts of spent nuclear fuel shipments under normal and accident conditions for a range of road and rail routes through rural and urban areas across the country. The study included improved event trees, which were used to estimate the probabilities of accident conditions. Fire scenarios were extended to consider very low frequency events, such as the failure of large rail tank cars loaded with hydrocarbon fluids in which all of the fuel in the tank car is released and assumed to form a pool. The pool is conservatively assumed to be no larger than needed to support a fire that would fully engulf the cask and prolong the duration of the fire. Next slide, please.

Also in the study, finite element analyses were performed to analyze how casks responded to impact in thermal accident conditions. NUREG-2125 also includes an assessment of consequences involving criticality and concludes, and I quote, “that criticality is not a credible scenario.” The familiar computer program RADTRAN was used to calculate routes -- routine doses, I’m sorry, and accident dose risks for representative truck and rail shipments. Next slide, please.

The collective dose risks from routine transportation are very small. These doses are about four or five orders of magnitude less than collective background radiation doses over the same time period in exposure population as the shipment routes. There was little variation in the risk per kilometer over the

routes analyzed. Next slide, please.

The study found that radioactive materials would not be released in an accident if the used fuel is contained in an inter-welded canister inside the cask. Only rail casks without inter-welded canisters would release radioactive material and only then in exceptionally severe accidents. If there were an accident during a spent fuel shipment, there is a less than one in a billion chance that that accident would release -- would result in a release of radioactive material. If there were a release of radioactive material in a spent fuel shipment accident, the dose to the maximally-exposed individual would be non-fatal.

And then finally in summary, the individual and collective doses calculated for a single shipment are very small. Maximum individual doses are comparable to background and collective doses from routine transportation are on orders of magnitude less than the collective background dose to the same population. The Spent Fuel Transportation Risk Assessment Study concludes -- conclusions reaffirm that estimated radiological risk from spent fuel transportation conducted in compliance with NRC regulations are low, in fact, generally less than previous estimates which were already low. Next slide.

NUREG-2125 provides a more complete and realistic assessment than earlier risk studies. However, NUREG-2125 does not contain a systematic assessment of the potential for phenomenon that may not occur in design-basis accidents, but could become more important under more extreme conditions associated with beyond-design-basis accidents. To address the ACRS's conclusion regarding the second bullet point on the slide, to staff -- the staff plans to assemble a panel of structural, thermal, and material experts with experience in spent fuel cask accident conditions analysis testing and certification at

Oakridge National Laboratory. The panel will conduct a systematic assessment of the potential for phenomenon under extreme transportation impact and fire accident conditions that could significantly affect cask performance. In particular, the NRC staff will ask the panel to focus on any phenomenon that do not already fall under the regulatory guidance in Title 10 CFR Part 71. Draft NUREG-2125 shows that due to significant safety margins, operational experience with thousands of spent fuel shipments and extensive testing and analysis, including beyond the transportation equivalent of design-basis accident conditions, have not identified or indicated any significant unevaluated phenomenon. The systematic assessment should confirm the potential for such phenomenon. The NRC staff will update draft NUREG-2125 with the outcome from the panel's assessments.

The analysis in NUREG-2125 -- wait a minute. That's it. Nope, one more, sorry. The analysis in NUREG-2125 continues to support the conclusion that radiological risks from spent nuclear fuel transportation are very low. These accidents will occur with extremely low probability, less than one in a billion. Also in the study, finite element analyses were performed to analyze how the risk -- how the casks responded to impacts and thermal accident conditions. NUREG-2125 also includes an assessment of consequences involving criticality -- included that criticality is not a credible scenario.

And finally, the staff are also considering reviewing moderator exclusion, extended storage and transportation, cask robustness, aging management, and stress corrosion cracking. We are aware of these studies and will continue to follow them in our future work. With that, thank you very much.

SAM ARMIJO: Thank you, Mike. John.

JOHN STETKAR: Thank you. I'll give you a brief overview of our review of draft NUREG-1855, Revision One, guidance on the treatment of uncertainties associated with PRAs in risk-informed decision-making. Next slide.

NUREG-1855 was originally published in March of 2009, so it's been around for a while. And since that time, it's become pretty much a primary reference for treatment of uncertainties in risk-informed decision-making. It's referenced in a few Reg Guides. I didn't try to develop an exhaustive list, but a couple of the most notable ones are highlighted here, Reg Guide 1174 and 1200 extensively reference NUREG-1855 for guidance on how to treat uncertainties. Next slide, please.

Our reviews of Revision 1 to the NUREG -- we had two subcommittee meetings in June and October of last year. We completed our review in December and sent you folks our letter in January. Next slide.

A few highlights of Revision 1. It contains a few refinements to specific areas of the guidance in response to comments that have been received over the last two, three, four years as a result of workshops that have been held and actual practical experience in the industry in developing risk-informed applications and trying to use the guidance. So, Revision 1 fixes up a few of those things. The report format itself has been reorganized to more closely follow the tasks' progression in the development of a risk-informed licensing application so it more closely tracks what an analyst would actually do in a practical application. Next slide.

It also more closely specifies the levels of analysis needed to meet the technical capability requirements of the ASME/ANS PRA standard. So, for example, if you want to meet capability category two, you should do this; if you

want to meet capability category three, you should do something else. The NUREG also adds a new section that includes guidance and expectations for NRC staff reviews of the areas of uncertainty in terms of treatment of completeness uncertainty to some extent, parametric uncertainty to quite an extent, and modeling uncertainty when the staff receives a risk-informed licensing application. Next slide.

Our first recommendation in our letter was that NUREG-1855 Revision 1 provides valuable guidance for the treatment of uncertainties and it should be issued for public comments. The next thing I'm going to do is I'm going to spend a little bit of time to discuss two specific issues that we highlighted in our letter. Next slide.

The first issue is -- I'll characterize it as -- in the context of understanding the available margins to acceptance criteria in decision-making. This gets a little deep, so I'll try to cover it a little bit. NUREG-1855 as it stands emphasizes a need for enhanced attention and evaluation of uncertainties when what we call the point estimate results from an analysis are close to a decision criteria. In other words, it emphasizes a need to really look at uncertainties there. And that's -- that certainly we agree with that. It also indicates though that a less comprehensive treatment of uncertainties is needed if those point estimate results are further away from that margin. Next slide.

Characterization and understanding of uncertainties is an important input to any decision-making process. The assessment of uncertainties provides important information about the degree of confidence in your available margin. In other words, how large is that margin? Is there some probability that indeed we might exceed that margin? If there is, how large is that probability. We need to

understand that information when we make decisions. The available margins can also affect practical decisions on which option you might select to implement. For example, option A might have larger margins than option B, even though both options are nominally acceptable in terms of looking at a single point estimate evaluation. And we found real practical experience that the evaluation of uncertainties can also identify sources of optimism in those initial estimates that people make. It can also identify sources of conservatism because in many cases our uncertainties are large and they may be skewed and our so-called best-estimate mean value might not quite fall into the tails of a probability distribution. It might be substantial probability that the value is less than that best estimate. Next slide.

So one of our recommendations in the letter was that the staff should consider revising the guidance in the NUREG to note that the assessment and review of uncertainties is important for all risk-informed applications regardless of what those point estimate comparisons show relative to a decision criterion. Next slide.

The second example that -- from our letter that I'd like to briefly review is under the context of implementation examples. In 2009, before the original version of the NUREG was issued, ACRS issued a letter that was rather critical of examples that were then included in an Appendix A to the original version of the NUREG. The NUREG was subsequently issued without that Appendix A. In Revision One of the NUREG there are references to two specific EPRI reports that now contain essentially the same examples in the context of EPRI guidance for the practical development of a risk-informed licensing application. Next slide.

Our concerns with those examples, and these are kind of reiterated from 2009, is that the process emphasizes the use of sensitivity analyses in lieu of really developing and characterizing an expression of the uncertainties. The screening and sensitivity examples presuppose or presume that the point estimate results are always conservative, which is not necessarily the case. So they tend to do things like examine the degree of conservatism in a number rather than evaluate the true uncertainty about that value. And similarly, the sensitivity analyses are not organized very well to inform a complete range of the possible uncertainties. Next slide.

Our conclusions were that the guidance in NUREG-1855 Revision 1 provides an appropriate framework for the identification and quantification of uncertainties. In other words, the NUREG itself is very good guidance regarding what should be done to characterize and quantify uncertainties. However, the examples now in -- that are now referenced in those two reports don't clearly demonstrate appropriate applications of the guidance. In other words, they -- they're not really representative of the best practices in how to practically implement that guidance to characterize and quantify uncertainties. Next slide.

And as a final recommendation in our letter of very early this year, we recommended that the NRC staff should also initiate efforts to ensure that the principles embodied in NUREG-1855 are more consistently applied throughout the agency when we're doing our own evaluations and making decisions. And that completes my briefing.

CHAIRMAN MACFARLANE: Great. Thank you very much. We will now take a short five minute break and come back for Commissioner questions.

[break]

CHAIRMAN MACFARLANE: So we'll now start off questions, and we'll start with Commissioner Magwood.

COMMISSIONER MAGWOOD: Didn't know I was first. First, again, as always, thank you. The, you know, the advice the ACRS gives the Commission is truly invaluable. There's been so many occasions where the Commission's debated some complex issue, and we've been able to turn to an ACRS letter and use that as a clear point of conversation, because your external input, your technical expertise, I think, is something that has helped us on multiple occasions. So we greatly appreciate it.

It occurred to me that you probably never really know how your recommendations and suggestions are digested and utilized by the Commission, but let me tell you, it's quite constant and quite regular, so we appreciate it. So the effort is very much appreciated.

I think because Dennis sort of was chatting with me on the sidelines -- didn't you do this Gen-4 thing?

MALE SPEAKER: [laughs]

COMMISSIONER MAGWOOD: Yeah, I was thinking I could have made -- I'm not sure it's the first Commissioner to ever do this, but it gives me the opportunity to ask you questions about technology I actually named.

[laughter]

That's probably pretty close to being unique. And so let me ask you a question about the NGNP, which I did indeed name. And that is, you know, when you look at the use of PRA to understand the events -- the licensing basis events -- did you -- is there something about events -- not just in NGNP but really

more broadly about these events, technologies. Is there something about the advance -- analyzing the advance technologies that's substantively different from analyzing light water reactors?

DENNIS BLEY: Well, I think the processes for analysis are similar. I mean, when technologies are different, you need the scientific background, the experiments, the theory to go with it. But for the basic analyses -- you brought up PRA -- the basic techniques are the same. You have to call in everything that's available from the engineering analyses and physics and chemistry analysis to support that work. The framework's the same.

COMMISSIONER MAGWOOD: The framework's the same.

DENNIS BLEY: The details may be different.

COMMISSIONER MAGWOOD: The -- right. I mean, the inputs are different, but the process is the same. So as you've gone through this -- the exercise of considering how staff would approach using more risk-informed approaches than somewhat the PRA-based approaches to look at NGNP, do you think there's any larger lessons for how we use PRA in our other work, in our more day-to-day work? We've had a lot of conversations, particularly since Fukushima about how one might expand the use of PRA. And there's been a lot of discussion both within the agency and with the Commission. I'm just curious as to whether there's any lessons we could draw from the experience that you've had.

DENNIS BLEY: I think so. And I think if you look at what was proposed here and overlay that with Commissioner Apostolakis' task force report on a framework for using risk, you see a lot of overlap. A lot of things are very similar.

You know, when you just start in the beginning, you say, "I'd rather have deterministic." Perhaps you say that. And you think about what we use our best judgment and come up with the best idea. But when you can then expand that idea and consider the alternatives near it and evaluate them, often you could find surprises. So I think often a probabilistic approach -- it's got to be anchored to the best knowledge you can bring to it -- can identify places where somewhat unlikely conditions aligning can lead you into significant problems that you wouldn't have thought of otherwise. So I think it gives you a lot of opportunity.

COMMISSIONER MAGWOOD: It sort of ties in a bit with the edge effect discussion --

DENNIS BLEY: Well, exactly, yeah.

COMMISSIONER MAGWOOD: -- that John was talking about a few minutes ago. You -- speaking of deterministic, you mentioned that the staff had intended to apply deterministic event sequences as part of -- I guess as a stopgap -- or as a -- in some effect. Can you explain what the thought process was there?

DENNIS BLEY: They proposed that after the process described by DOE had been carried out, that it would be appropriate to add new design basis accidents based on judgment of thinking, "Well, this might be important in adding it." And after discussions, the ideas is that -- certainly those -- we'd hope they'd already be thought of because we would think that the systematic approach that they described for building the PRA would identify a broader set of events.

But if, indeed, you think of something new, then rather than assigning it without real detailed thought behind it to -- a design basis accident that has to be analyzed deterministically, you would process that event through

the PRA, understand it more thoroughly, understand what the defenses for it in the plant are, and then evaluate it.

Now, of course, anything coming out of that PRA process that tries to look at the full uncertainty that can be identified, you can think and say, “Well, maybe we didn’t think of everything. Maybe I’m worried that the experimental basis for this isn’t as thorough as it should be.” And I want to add additional -- you could almost call it defense in depth to protect against that. So there might be something that wouldn’t have gone through the sieves, right, to come up to be a design-basis accident. But you’re not convinced if the science is known well enough and, in fact, you would elevate that. So --

COMMISSIONER MAGWOOD: So eventually it comes -- it’s a defense in depth approach. Basically, you’d just -- based on the uncertainty of the model.

DENNIS BLEY: But we felt that it actually made sense to integrate that into the process already described. And then at the end see that either you agreed with the analysis or there were reasons you thought it needed to be elevated.

COMMISSIONER MAGWOOD: Let me ask you to give me a general opinion, because something that comes up quite frequently from the research community, and we’ve seen this actually in, to some degree, with actual projects, that there’s an opinion that it’s too hard to license a new advanced technology in the U.S. framework. And, you know, I personally don’t think there’s evidence to support that, but it’s said quite frequently. I wonder if you have a -- you’d like to make a clear statement about that.

DENNIS BLEY: The process we have is adaptable. And when you run into problems that don't fit the mold, the staff asks additional information, the applicant goes develops that work, and so it is adaptable.

There have been feelings that, you know, it kind of grew topsy over the years, so maybe there's a better way to organize it. And that's a big job. So even though it grew like topsy, it's been fine-tuned a bit. And I think the work going on in NRO looking at these -- Charlie, I forget what they call them. The DS --

CHARLES BROWN: DSRS?

DENNIS BLEY: Yeah, the DS -- the design specific review guidelines -- is a good way to, you know, it's really adapting what we have. But it's going in and not just saying what doesn't apply. But it's also saying, "Is there something unusual about this design that requires something a little more than we've had before?" So it seems, you know, kind of an evolutionary way to move in that direction. I think what they proposed here is of that same character.

COMMISSIONER MAGWOOD: Thank you. Appreciate that. Let me shift to Dr. Brown for a moment. The -- you know, I appreciate your discussion about the digital I&C, and it's something that obviously is -- comes up quite frequently, both in the U.S. and internationally.

It seems like I recall having conversations with people, probably 15 years ago, about how -- it was too hard to get digital I&C through the Nuclear Regulatory Commission. And I don't know -- maybe the person who put that first application is still waiting for the answer. I don't know, well -- that was always the belief. And I think that many of the vendors are probably -- tell you that it is hard,

and there's reasons for that. And I think you highlighted some of the reasons. It's because of some of the questions that you highlighted.

But one question I've often asked myself but never really had a good, clear answer for, is when we look at digital control systems, do we look at it differently than other fields look at it? I mean, obviously, aerospace has gone largely digital and they apply it quite widely. And they have the same kinds of safety concerns that we do, that, you know, you want to make sure that your airplane doesn't decide to do something it's not supposed to do because of a software glitch.

What lessons learned from aerospace that apply here, and what's -- is there a basic difference between how we approach it and how they approach it?

CHARLES BROWN: Yeah, I think so. Can you hear me now?

[laughter]

The answer to that is yes. In the aerospace world -- I'm going to contrast two specific points. They obviously have to monitor lots of information and display that to pilots -- whoever's controlling the aircraft or what have you. But the fundamental area that they have to deal with is real-time control. So now you're taking data and you're feeding it back to automated control systems or you're feeding that out to, you know, controls to your flaps and your other control devices on the airplane. There's feedback back into the circuits to tell you what you're doing with that. That's totally different from what we have to deal with in the reactor trip and engineered safeguards. It is not a real-time back-and-forth communication and altering information based on the response of the systems. You want to tell the reactor to trip or not trip. After that, it's over, okay?

You provide data from the plant to the operators, and it's a continuous stream. You don't take that data back and say, "Well, gee, I don't like that. I'm going to give you some different data based on some other state of what's going on." You're just getting a real-time stream of data.

And the same thing applies roughly to the safeguard systems as well. Those are not -- you're not modulating most of the control systems that actuate the safeguards: start the pumps, open the valves, et cetera, et cetera. So there is a major difference between the issues that the aerospace world and the aircraft world have to deal with as oppose to the reactor world. Did I answer that appropriately?

COMMISSIONER MAGWOOD: No, I appreciate that. So it's not a good analog.

CHARLES BROWN: No, that's not to say that there aren't certain principles that, you know, in terms of independence, how you make sure you don't interfere from, you know, the multiple channels. There are fundamentals you deal with, but if you look at the application, they are -- there are differences.

COMMISSIONER MAGWOOD: Excellent. Thank you very much. Thank you again. Thank you, Chairman.

CHAIRMAN MACFARLANE: Thanks, Commissioner Magwood. Commissioner Ostendorff.

COMMISSIONER OSTENDORFF: Thank you, Chairman. I want to echo Chairman Macfarlane's accolades for Dr. Shack and for the entire ACRS work effort and those of Commissioner Magwood and his comments to the entire body, not just those at the table here. And Commissioner Magwood's exactly right in saying that, you know, the ACRS members may not ever fully appreciate

the extent to which we rely upon your solid, sound technical advice in your letters in formulating our own vote papers when we decide on an important policy matters. So I appreciate my colleague mentioning that very important point.

I want to start out with a couple of questions for your Chairman, Dr. Armijo.

SAM ARMIJO: All I did was present the intro.

[laughter]

COMMISSIONER OSTENDORFF: Well, we would not want you to feel neglected.

[laughter]

So, a little over a year ago, there was some discussions the Commission had with the ACRS and with the EDO's office on kind of the synchronization of papers and timing of schedules. And did the ACRS have the opportunity to review a matter, have a meeting and comment on it, write a letter before the Commission voted on the matter? My sense is that's getting a lot better, but I'm just curious as to how you think it's going.

SAM ARMIJO: Oh, I think it's a lot better. You know, a lot of that was done in the numerous activities that were going on in parallel as a result of Fukushima. And so there were very tight schedules that had to be met, and everybody was scrambling. We worked around those problems, but now things have stabilized and I don't see a real scheduling problem.

COMMISSIONER OSTENDORFF: I appreciate how you all worked that, Ed, and the EDO's office and SECY office on trying to get -- it's a significant improvement.

SAM ARMIJO: Yeah.

COMMISSIONER OSTENDORFF: That's good news. Second kind of administrative question is -- I know you had, you know, there's peaks and valleys of ACRS work and so forth. How do you compare the workload for the next 12 months compared to the prior 12 months?

SAM ARMIJO: Well, everything we should have done in the last few months, things were delayed and pushed back. And in fact, we were having some very, what I call "light" meetings -- not too much to handle. It's coming back. And so we see that bow wave coming back. In the next few months, we're going to have to work that down. But, again, it's certainly manageable.

COMMISSIONER OSTENDORFF: Yeah, okay, very good. Thank you. I'm going to turn to Dr. Shack here. You -- just right before this meeting, I had a discussion with Mike Johnson, who's talking to individual Commissioners this week on kind of where you are on station blackout. I know that station blackout rule and the efforts are so important as one of the top lessons learned on Fukushima events. And I really appreciate what you all have done as a body on this particular issue for the rulemaking.

A couple of things I wanted to ask you about specifically related to permanently installed equipment versus portable equipment that you move into place and the robustness of that equipment. One of the things I know that other Commissioners do, in addition to myself, when we go visit nuclear power plants, we look at their flex equipment and the B.5.b equipment and see where is it, how portable is it, and how diverse is the potential application based on its portability and its location? And it seems to me that -- you know, my personal reaction has been it's been fairly positive to have this portability issue in there, even though it does require people to move it.

I know on submarines, we had -- look at my Naval reactors colleague, you know, from years past here. The emergency diesel generator was in one location in a compartment, and if that diesel generator space had a fire, then you had a real problem if you had a scram at the same time. And so the lack of portability of that particular piece of equipment, it couldn't have been otherwise on a submarine, but that was a constraining factor. So, the fixed versus portable thing, I can see it from both sides. I'm curious as to any particular concerns that you weigh the fixed versus the, you know, portability with human error issues. Is that what I'm kind of taking away as one of the concerns?

WILLIAM SHACK: Well, I think there's tradeoffs both ways. I mean I think you, you know, you do introduce the possibility for human error, but the committee I think looked at both sides. I mean we like the notion of flexibility, you know, especially when you haven't got defined scenarios, but it is a tradeoff. I mean that there is, with that built-in power source, you have much more power. You know, you could get a full safety trains back if -- and it's there with the, you know, flick of a switch in the control room kind of a thing. But if something's really wrong somewhere, then you know, now obviously the best of all possible worlds is to have both, and it's not clear to me that since the licensees have committed to flex as an industry effort, that will be there whether we call for AC supplemental power sources or not. So, I'm not quite sure how all this would play out, but as I say, many on the committee share your notion that flexibility, you know, having various points of attachments, various ways to do things, is a good thing when you don't have a defined scenario. You're just not quite sure what's going to happen, but again, we do feel that, you know, that there is under

stressful conditions there is certainly an increased chance for human error, which is why we want to look at the feasibility of these actions and try to do it.

COMMISSIONER OSTENDORFF: I'm glad you all are discussing it. My personal view as a former operator for many years, I'm a big believer in portability and flexibility, but I realize there's some downsides to it. I'm going to stay with you for one --

WILLIAM SHACK: You have some strong supporters on the committee.

COMMISSIONER OSTENDORFF: Recognizing again, go back to Mike Johnson and the steering committee from Fukushima trying to move these things out in a fairly aggressive fashion to get things in place, recognizing that adding equipment requirements to existing already-built plants is a far, far different calculus than a blank sheet of paper for a new plant, radically different issues. And I think the flex -- my personal views are the flex initiatives have been moved out fairly quickly on a relative scale across the industry with, you know, a lot of interface obviously with the NRC.

WILLIAM SHACK: I think the ACRS is very interested in seeing some of the outcomes of the mitigation strategy report. I mean one of the things about a performance-based approach is that you're, you know, there's a lot of different ways to do it, and it will be interesting to see the different approaches that different plants have taken.

COMMISSIONER OSTENDORFF: Did you all have a chance to be briefed by Palo Verde on their approach?

WILLIAM SHACK: No. We haven't been briefed by anybody in any -- you know, that's something that was part of our SBO letters that we, you know,

we would like to do that with those evaluations, because we see such a range of possibilities that the people will take, and some will probably be more robust than others.

COMMISSIONER OSTENDORFF: I mention that earlier this year, I had a detailed briefing from their team when I was out in Arizona, and I think that their approach was one of the more mature efforts. They've gone in greater depth and it might be worthwhile for you all to consider.

SAM ARMIJO: That's a good idea. Commissioner, in a couple of weeks we'll be visiting the Peach Bottom site, and we will be reviewing their flex, and also since they were the model for the spent fuel pool study, we're reviewing that, so we'll see the real equipment.

COMMISSIONER OSTENDORFF: Good. I encourage you all to do that. I'm going to ask -- I've got time for one more question. I'm going to ask Dr. Ryan a question here.

MICHAEL RYAN: Yes, sir.

COMMISSIONER OSTENDORFF: I appreciate that the study you are talking about basically characterized the risk of transportation as being very, very low, however many verys you want to put in there. Yet at the same time, the public perception of this risk is not necessarily low, and you know, I'm curious as -- do you have any thoughts on how perhaps we as an agency might better communicate these low risks externally?

MICHAEL RYAN: I think if you look at the history of cask transportation, a big, heavy unit with radioactive material in it, and then there's lots of examples over a broad range in the industry. They've all gone through increasing levels of design, of testing, and of limitation on what they're allowed to

take. One thing that would be of great benefit would be two things. One is a technical review of that history, and the second is a public affairs presentation of that history. And I think that, you know, if it's with regard to an accident, or something happened somewhere, it's always kind of a crisis, and that's hard to be in an effective communication mode for a teaching outcome if you've got a crisis. So, I would say that something proactive that, you know, develop that history in a reasonable way. Now, maybe there's two parts. There's a technical part perhaps for practitioners and perhaps folks that might want to pass that on in a non-technical way to a public audience, that's what I would think about to approach that gap. In my days at Barnwell, South Carolina, we did an awful lot of that sort of thing with regard to disposed waste, you know, which is also another question that comes up. So, it's incremental. It's one person at a time. It's going and visiting somebody's living room and talking to them about a concern, or whatever it might be, and I think if you have a program that, you know, uses effective tools that are factual and accurate, and up to date, and you deliver it in a way that's not in a classroom and not a, you know, an open forum that's bright lights and, you know, photographers and the rest, it's a much easier way to get it across. So, that would be my strategy.

COMMISSIONER OSTENDORFF: That's very helpful, thank you, and again my thanks to the entire ACRS body. Thank you, Chairman.

CHAIRMAN MACFARLANE: Thank you. Okay, my turn next. I'm going to start with Mr. Stetkar. I thought you gave an absolutely excellent explanation of a very complicated topic, so kudos to you, on the importance of uncertainty analysis. Well, you sort of said, "Oh, it's complicated and I'm going to get into the weeds," but it was very clear. So, thank you. And I wholly agree with

your analysis, and appreciate the emphasis on uncertainty analysis, and your noting that the staff should be more consistent and do it more thoroughly across all aspects. So, is uncertainty analysis difficult?

JOHN STETKAR: Not in my mind.

[laughter]

CHAIRMAN MACFARLANE: Okay, good.

JOHN STETKAR: But that's me. It's difficult if not --

CHAIRMAN MACFARLANE: Well, if practitioners don't think it's difficult, then it shouldn't be difficult. You just have to be a practitioner.

JOHN STETKAR: It's difficult because it's a discipline and it's a discipline that many engineers have not been trained to employ in their day to day thinking -- because --

CHAIRMAN MACFARLANE: As a scientist, when I collected data, you always had to have the uncertainties attached to that data, otherwise it was useless, meaningless.

JOHN STETKAR: Engineers understand that concept but engineers also like to be very precise, and --

CHAIRMAN MACFARLANE: Well that's theory. Reality is the imprecise thing, you know what I mean?

JOHN STETKAR: That's fine. If you instill that discipline, that whenever you're doing an analysis, you should -- people always present to decision makers, "This is my best estimate," and engineers should be trained and there should be a discipline to say, "Well, what's the basis for that best estimate? Have you looked at your range of uncertainty? Do you understand the inputs to that uncertainty? Have you looked at the data? Have you looked at supporting

expert judgment?" if there's limited data available and so forth. Understand the ranges. If there's some higher probability that a value might be in a certain range than another range, have you accounted for that, and then based on that, can you then express your expert opinion with the associated uncertainty? And in many cases we found that engineers don't necessarily appreciate the compound effects of uncertainties, because --

CHAIRMAN MACFARLANE: That's the problem.

JOHN STETKAR: -- I might evaluate this particular element of an analysis to the best of my ability, but I don't really understand necessarily how it interacts with this other piece of the analysis, which another engineer might have evaluated to the best of their ability. And if we're not careful about propagating those uncertainties about accounting for those uncertainties in the integrated analysis, we might miss something, and in fact we have evidence that that occurs, especially when we had very broad uncertainties. So it's difficult because indeed it's a discipline that needs to be instilled. If you get into the mathematics, if you like really complex math, people can make it sound really, really difficult, but the real hurdle to get over is that discipline.

CHAIRMAN MACFARLANE: Yes, thank you. I mean, I grew up with Monte Carlo analyses and --

JOHN STETKAR: Yeah, you can talk about different sampling algorithms and things.

CHAIRMAN MACFARLANE: These are actually standard methods. It's not some --

JOHN STETKAR: Sure. This is not black magic.

CHAIRMAN MACFARLANE: Exactly. Thank you. Well, I appreciate your emphasis on that.

JOHN STETKAR: It's gray magic.

CHAIRMAN MACFARLANE: Oh no. It's standard practice and it has been for decades in the sciences to do this kind of analysis.

JOHN STETKAR: And in other industries.

CHAIRMAN MACFARLANE: So, yes. I appreciate your emphasis on that.

Dr. Ryan, a couple of questions about the study that you analyzed, that I'm not so familiar with. So, in terms of the rail accidents that the study used, did they use -- first of all, did they use existing rail conditions or idealized rail conditions, because existing rail conditions are not necessarily so good?

MICHAEL RYAN: And I think that goes into two things. One is the selection of routes for these shipments, so they kind of stay away from the ones that have the "under construction" signs, and so I'm going to --

CHAIRMAN MACFARLANE: It's not even under construction. Some of them are just too narrow gauged, you know --

MICHAEL RYAN: Narrow, that's right, and so I think that comes into the selection of routes. So, they avoid, you know, places where there's marginal rail capability.

CHAIRMAN MACFARLANE: Okay, so they did do that? And did they include actual rail accident experience? I'm thinking in particular the most recent one in Quebec, which was quite alarming, the guy didn't put enough of the brakes on or something.

MICHAEL RYAN: Derailment is a case that is evaluated, and it's assumed that it derails in a way that, you know, the most sensitive parts of the cask are attacked by the force, and so forth, so…

CHAIRMAN MACFARLANE: Okay, good. And did the study address – did it look at transporting and the risks of transporting high burn-up fuel which after long term storage may become embrittled?

MICHAEL RYAN: Yes. It was a wide range of fuels, fuel types, fuel burn-ups that were evaluated.

CHAIRMAN MACFARLANE: And the potential for embrittlement of those --

MICHAEL RYAN: All of that, yes.

CHAIRMAN MACFARLANE: Okay, good. All right. That's what I was interested in. Dr. Armijo. Seeing how you mentioned the spent fuel study that you guys have been reviewing, and I know you discussed it in subcommittee earlier this year, and again I think last week or this week?

SAM ARMIJO: This week.

CHAIRMAN MACFARLANE: This week, yeah. Okay, good. So, it's right front and center, hopefully --

SAM ARMIJO: Yes, ma'am.

CHAIRMAN MACFARLANE: Or whoever else has been looking at it can jump in, I don't really care. You know, and as you pointed out, it focuses on Peach Bottom, a single BWR plant.

SAM ARMIJO: That's correct.

CHAIRMAN MACFARLANE: So, in your view, is this adequate to really cover the wide range of pools and pool conditions that exist in the country?

SAM ARMIJO: Well, the answer is no. There has to be an evaluation of the entire fleet. If every plant was identical, it would be a very, very good model, but we know they're not, and the staff is addressing that with I believe Tier 3 activity.

CHAIRMAN MACFARLANE: Okay. Good. All right. Dr. Shack. Going down the line here. On Slide 31, if I can find Slide 31 -- can't find my own versions here. Yeah, okay. On Slide 31, you recommend that the staff consider results of ongoing integrated assessments of external hazards to determine if available margins are adequate for the development of mitigating strategies. So what actions would you recommend if the staff finds that there isn't adequate margin?

WILLIAM SHACK: Well, I think that you would review the mitigating actions in light of the margins that you expect or that's, you know, since this is a performance based approach, that is something that you would reflect on at that particular site for the margins that they have, and just so you will be evaluating their mitigating strategies in terms of your perceived -- or your perception of whether they in fact should account for additional margin in some external event, flooding-related. So, this will be very plant-specific, and you know, certainly not all plants will have any need, or in fact there might even be none, but simply we've just looked at it as a caution for not accepting the design basis as the sole determination of what the margin -- recognizing, again, as Mr. Stetkar would say, there's uncertainty in that. And you know, you have to make a judgment of what that uncertainty is, and how well that's being addressed by the mitigating strategies that are proposed. It comes back to this whole thing, you know, a performance-based approach has strengths and weaknesses. One of them is

that it will be different at each plant, and you know, it will require essentially a lot of NRC effort I think to review many of these mitigating strategies because it won't be cut and dry. You know, there won't be a standard analysis that you apply, because people will be starting from very different situations. You know, if you've replaced your coolant pump seals, that's one situation. If you're trying to deal with that leakage, it would be a different situation.

CHAIRMAN MACFARLANE: Okay. And in terms of the external hazards themselves, did you feel that the staff did an adequate job of, you know --

WILLIAM SHACK: That's coming out of the 2.1 exercise. I mean you know, we know there's going to be changes in the seismic hazards. We have much less knowledge and understanding a priori of what's going to happen with the other hazards, but we know they're being reevaluated --

CHAIRMAN MACFARLANE: Right.

WILLIAM SHACK: And we just want to make sure that those are reflected in the mitigating strategies.

CHAIRMAN MACFARLANE: And did you feel the staff was looking at a complete suite of external hazards?

WILLIAM SHACK: A complete suite, of course we had some discussion on that --

CHAIRMAN MACFARLANE: Did you? I'm interested, yeah.

WILLIAM SHACK: -- in the interactions of those, but I think in all fairness they're looking at this in a great deal more depth than we have before, recognizing from Fukushima the potential for interactions that you hadn't perhaps, you know, had made quite so clear to you before, that people might

have speculated about them. But there's nothing like a concrete example in front of you to really focus one's attention, so I -- you know, we haven't had a chance to review any of those results, but I think that people are certainly sensitized at this point. So, we have -- but as I said, I want to make sure, you know, the 2.1 guys aren't working in their chimney and the mitigating systems people are working over here in their chimney, and they don't look across.

CHAIRMAN MACFARLANE: Right, right. Okay, I appreciate that. Thank you. Commissioner Svinicki.

COMMISSIONER SVINICKI: Well, good morning and thank you. I add my thanks to all the members of the ACRS and I did want to take a moment, I didn't at the beginning, to thank Dr. Shack specifically for his long service on the ACRS. It's a strange moment for me. I don't know an ACRS without Dr. Shack on it and it's rare. There may have been one or two instances over the years I've served on this Commission that Dr. Shack has not given a presentation at this meeting, because you tend to be sitting not only serving on the ACRS, but sitting at the table. And so it will be when next I sit here with the ACRS, not to have you here I will feel momentarily adrift I'm sure, but then I will look at Dr. Powers, and I will be okay.

[laughter]

He will be here. And the other thought I had is as many people of tremendous accomplishment, you are humble, and quiet, and modest, and I could feel your discomfort as the Chairman read your long list of accomplishments, and I thought if we make this spectacle uncomfortable enough for ACRS members, maybe others sitting here will then put off their retirements, which to me would be very good thing. So, I thought we ought to make a grand

spectacle of it so that none of you want to go through that little ceremony. So, but thank you again for your --

CHAIRMAN MACFARLANE: It wasn't that bad.

[laughter]

COMMISSIONER SVINICKI: No, but you can tell -- I mean these -- a lot of the members of the ACRS, and I stood through a number of these ceremonies, it's clear that they're not people who want to stand up and have all their accomplishments read aloud, because they tend to be not wanting to have the spotlight on them, and so again, to thank you for your long service to the ACRS. I think we benefit not only from having an advisory committee of a diverse group of such accomplished individuals, but the willingness of some members to have long service, I'm a believer in this when it comes to the ACRS, because you see issues come in different manifestations, and I think your ability to give advice to the Commission over long periods, given that longer perspective I think is uniquely valuable to us. So, thank you to you and to others who -- when they're having to consider whether or not they want to seek another term of service on the ACRS again. I'm very grateful and I try to be the quickest to vote approval on those, but sometimes Commissioner Ostendorff beats me because he's very, very quick.

WILLIAM SHACK: Well you told me you did that, but it was before we could change our minds.

COMMISSIONER SVINICKI: There's that too because, you know, once voting begins on your reappointment, of course it's a very complicated procedure to stop that voting process. So, you can't pull out, but I was going to take this opportunity to ask you then to reflect on your long service on the ACRS,

and ask if there is any advice you would have of things the Commission could do or do better to ensure that, again, the very invaluable service that's performed by the ACRS, that the committee itself is resource-equipped, and informed in ways that allow it to do that important role as significantly, and do it as well as they do it. Is there anything the Commission itself could be doing better, and this is your moment in time to give blazingly candid advice that you normally cannot put in an ACRS letter.

WILLIAM SHACK: I hadn't thought about this one. No, you know, I think that the ACRS has been well supported over my time. I have -- things happen, you know, with schedules are sometimes out of control, you know, and I think as Dr. Armijo mentioned, you know, we have worked well with the regulatory -- the EDO and the regulatory people to work out schedules. Sometimes things just are difficult to do. Things are happening very, very rapidly, but by and large I think there's good cooperation between the ACRS and the other offices. You know, when we ask for information, we typically get it. They're very cooperative, and again, they have their schedules, you know, their problems there, but I don't see any systematic problems that I can identify.

COMMISSIONER SVINICKI: Okay, thank you. And again, in all seriousness, thank you for your tremendous contributions to the ACRS, and again, to all of your colleagues, I think you're an example of a group -- I haven't for a while sat in on any of your letter drafting sessions, but it's a lot of fun. But again, I think that you all typically work well together as a group, and yet I think you bring your different perspectives, and it's something that the NRC, it's a part of our culture and what we value. So, I appreciate when I can see it reflected in the committee's work, which is to take a diversity of views and yet try to find the

best outcomes for nuclear safety. So, I thank you for that work. My colleagues have covered a number of areas, as they typically cover the important points. I would just ask a point of clarification to Dr. Shack. In your presentation on station blackout, in commenting on this robust supplemental AC power source, I took your presentation to mean not necessarily recommending to the staff that they require that, but that they consider a credit for it should it be in existence, or should it be installed. Is it that -- but maybe I misunderstand that. The recommendation doesn't read with language that allows me to know one way or another. It says, "The staff should continue to explore the concept of robust, supplemental AC power source," but when you spoke today, you talked about crediting the existence of such a thing. Can you help me understand what the recommendation means?

WILLIAM SHACK: Well, I think what I said was we don't credit AC power sources now under the order. I think, you know, certainly the notion would be that if the supplemental AC power source robust was introduced, someone would expect credit for it.

COMMISSIONER SVINICKI: So that -- the crediting of it should be a permissible part of the strategy?

WILLIAM SHACK: No. We were careful. I think it was explored. It's the issue that we're dealing with, with Commissioner Ostendorff, that you know, if it became a tradeoff between that supplemental power source and the portable equipment, then I think you have to examine the tradeoffs.

COMMISSIONER SVINICKI: I think you answered the question when you said we were careful with it. So, you mean it's purposefully vague, and I can't tell on purpose?

WILLIAM SHACK: Purposely vague, yes. I don't think it's even purposely vague. I think you just have to consider the fact that there are tradeoffs between this robust source and the flexibility that you have. And I guess we're purposely vague.

COMMISSIONER SVINICKI: Okay. Thank you for clarifying your vagueness. The other topic, this is on digital I&C, but I'm following an interesting thread, which is always one of the interesting things about the letter reports, the staff's response, the committee's response to the staff's response, and then the staff's subsequent response to that. But this is on the topic of the data may be transmitted from the systems via network bus to the main control room, the technical support center, and the emergency support center, and in some cases it's shown as being transmitted through a firewall to a corporate network with access to the Internet. This is what the ACRS then says about that: "These types of architectural configurations that have access to the Internet can compromise control of access, thus possibly compromising the safety system information being sent. And I will read this in an abbreviated way. So, you go on to make a recommendation that as part of the staff safety review, the staff says that they need to assure -- they assure independence between safety-related and non-safety related I&C systems. And they feel I think that addresses the ACRS' concern, but then the ACRS writes back to say, "Our concern was not about communication links between MCR, the main control room, the technical support center, and the ESC, but communication from a common network bus which passes plant data from safety systems to these three locations, and that also passes plant control signals back to the safety systems." And I guess the staff's last response to you is NRC staff appreciates the ACRS recommendation.

The NRC staff is considering the recommendation. Can you give me any sense of kind of where this goes from here?

CHARLES BROWN: I'll give it a shot. I've been trying to get this point across for a long time now. A picture would be worth a thousand words right now, so I'm going to try to say the picture in about less than my normal 3,000 words. And if you consider the plant as a box and there's a trip system, there's another set of systems associated with the safeguards which are actuated or control systems that have to start pumps, open valves, et cetera. The data that's generated from the reactor trip system, nuclear instrument monitoring system, those go into this bus -- that's a picture of the box, and then aligned with the bus. Then it goes up to the main control room, technical support center, and possibly the emergency support center, depending on the design. When information for the controls comes back for any manual controls, they go back to that same network, and then down into the plant. That's an in-plant and main control room interaction. On that bus there's always, in every design we've seen so far, a little line with a box on it which says multiple things: plant computer, firewall, corporate network, whatever that means; and that firewall is supposed to, in whatever form it is, is supposed to prevent information coming in from the external world on to that bus. The point of our comment was if -- all you have to do is look what's going on in the real world today, that's a control of access thing. Put the cyber security point out, it's not -- it's a control of access to the plant. If you can have access to that bus, it's got computers on it. It's got servers. That information can then be fed -- tampered with, give errant information to operators, or even potentially actuate controls for certain devices in the plant.

The arguments on trying to define that point of access is where the fundamental disagreement is, and I'll try to characterize our perspective at least, and I will say it's mine, but the committee has at least supported that via our letters, is that should not be an intersection point that has any software control associated with it at all. In other words, if you want to send data outside the plant, not the main control room necessarily, but outside the plant to headquarters or some other facility, that should be a hardware-based diode, data diode which has no way of being externally turned around other than if somebody walked into the plant, ripped it out, changed wires, put it into a two-way one. It should be one way, no software support at all. The argument we've made is that should be determined or specified or ensured by the staff during design and licensing so that you know what's going to be there. The argument that you hear from people in the design world is, oh no, we've got great algorithms and we can make sure nothing ever happens, so it can be anything and we'll give you the choice at some point. The staff has also argued, and I'll try to phrase this the proper way, in that the new rule, 73.54, for cyber security, which requires a plan to be developed prior to, I think it's about a year before fuel load or six months before fuel load or something like that, that that plan embodies the ability to do whatever you need to do to make sure that's okay. The problem with that is if you don't have an architecture that supports -- the design is done now. The equipment is installed. Hardware is installed. The cables are run. The network's in place. All the stuff is at this point in time -- if the architecture doesn't support one way only, then you're -- what's the proverbial thing? You're what, up the creek or down the creek without a paddle or something like that. It's very difficult to recover. And you can say well, that's the designers. That's the licensee's

fault. That's not a good approach, and it's not a good approach from a safety aspect, in my opinion, for the agency to not have some emphasis on that architecture, how it's incarnated in the architecture at the design time that the license is granted. So that's where the conundrum is.

Now, I am optimistic, because I don't know what -- that was a very cryptic letter. It says we will take your thought processes on this second round under consideration. There may be different ways to skin this cat, but I'm hoping that they will have come forth with a proposal that is consistent with ensuring this ability at the licensing stage.

COMMISSIONER SVINICKI: Thank you. Your description even without a diagram was very illuminating on that point, and I'm certain there will be more engagement between the Commission and the committee and the staff on this point.

CHARLES BROWN: I can assure you of that.

COMMISSIONER SVINICKI: Thank you very much.

CHARLES BROWN: I hope.

COMMISSIONER SVINICKI: Thank you, Madam Chairman.

CHAIRMAN MACFARLANE: Thanks. Commissioner Apostolakis.

COMMISSIONER APOSTOLAKIS: Thank you, Madam Chairman. My first question is one of clarification, Dr. Shack. Traditionally when we talk about station blackout we assume that there is DC power, correct?

WILLIAM SHACK: Yes.

COMMISSIONER APOSTOLAKIS: On Slide 28, you're saying -- at least what we've learned from the Fukushima accident, you don't have to put it up, in one of your sub-bullets you're saying extended station blackout conditions.

These conditions, again, are the same as in the traditional station blackout? In other words, DC power is available? Now, the reason why I'm asking that is I was looking at the timeline that INPO has developed for Fukushima. Fifty minutes after the earthquake and 10 minutes after the tsunami, it says that the loss of DC distribution systems results in the loss of control room indications and alarms. So, is DC power now part of the game here that we are losing also or we may be losing DC power and that the original assumption under SBO that DC power is available is not valid anymore? Is that one of the lessons from Fukushima? I don't understand how that works here.

WILLIAM SHACK: Well, in the mitigating systems order it's assumed that you do have DC power.

COMMISSIONER APOSTOLAKIS: Well, that goes contrary to --

WILLIAM SHACK: Well --

COMMISSIONER APOSTOLAKIS: -- what we found in Fukushima.

WILLIAM SHACK: But I think, you know, that there's the question of how far beyond the design basis accident do you go? You know, you have the simultaneous seismic event plus a tsunami that's, you know, twice as high as your design basis. It would not be addressed by the mitigating --

COMMISSIONER APOSTOLAKIS: That's why we need the tsunami so large to lose DC power. I don't know.

WILLIAM SHACK: Well --

COMMISSIONER APOSTOLAKIS: If we have a slide that says here is what happened at Fukushima and we're trying now to come up with a different rule, impact on multiple units, yes. Failure of alternate AC power, yes. This seems to be one of the most significant findings from Fukushima, that 10

minutes after the tsunami you lost the DC distribution system. And I don't understand how that works. I mean, SBO is not the original SBO anymore.

WILLIAM SHACK: I think the question comes whether that comes under the mitigating systems order of the 2.1 where you're -- you have to have confidence that you've addressed your external events, I think, to an extent that this becomes -- you know, as I say, if you're saying beyond-design basis, that's an unlimited kind of condition and it's very difficult to deal with that.

COMMISSIONER APOSTOLAKIS: Well, it seems to me that -- I suspect you are once again deliberately vague.

[laughter]

Which is okay, I mean, you know, there may be other opportunities, not with you, but with others to raise the issue. But, that confuses me a little bit what we mean by SBO. The other thing I don't understand is your very last slide, the loss of decay heat removal is a separate condition and not just as a consequence of extended loss of AC power should be considered under recommendation one of NTTF and the RMTF. What does that have to do with recommendation one?

WILLIAM SHACK: Defense in depth. Again, the question of how much defense in depth do you need and, you know, to what extent do you have that defense in depth?

COMMISSIONER APOSTOLAKIS: Okay, so that was the idea.

WILLIAM SHACK: That's the connection there.

COMMISSIONER APOSTOLAKIS: Dennis.

DENNIS BLEY: Yes, sir.

COMMISSIONER APOSTOLAKIS: The -- I don't know why we're talking about the NGNP, but anyway, since you mentioned --

DENNIS BLEY: That's a good point.

[laughter]

COMMISSIONER APOSTOLAKIS: The selection of the licensing basis events would utilize the staircase curve that the technology-neutral framework proposed frequency versus dose?

DENNIS BLEY: They proposed an FC curve. It wasn't exactly the same one that was in the technology-neutral framework, but it was similar, and it was based on existing regulations and on other considerations.

COMMISSIONER APOSTOLAKIS: Okay. So it's not --

DENNIS BLEY: But they define what each piece of that staircase came from in terms of regulation or policy.

COMMISSIONER APOSTOLAKIS: Now, we were looking at this original curve from the technology-neutral framework, but maybe this applies to this curve as well. When you go to very rare events, and I believe in your letter you say that between 10 to the minus 4 and 10 to the minus 7 --

DENNIS BLEY: Roughly.

COMMISSIONER APOSTOLAKIS: And that's supposed to include external events as well.

DENNIS BLEY: Yes, it is.

COMMISSIONER APOSTOLAKIS: A 10 to the minus 7 earthquake is something the seismologists tell us they don't understand what that means. 10 to the minus 7 -- if you go to 10 to the minus 5 they will tell you what the state of the art is. When you start going below, the answer you get from them is we don't

know. Yes. I've asked people from the USGS and very prominent people who say 10 to the minus 7 we don't talk about them. So I don't know why we don't have -- how we can have a regulation that has a 10 to the minus 7 in it. I mean, and of course, that's an earthquake that would destroy everything. It was not just an accident sequence. I mean, you're talking about demolishing the whole thing. So, there's no way you can meet any criteria. I wonder whether this came up in your deliberations. If it didn't, it didn't.

DENNIS BLEY: We didn't delve into that at all.

COMMISSIONER APOSTOLAKIS: Okay.

DENNIS BLEY: But, yeah, I'll leave it at that.

COMMISSIONER APOSTOLAKIS: Mr. Stetkar. Your Slide 66 gives a recommendation that I like. I'll tell you what it is. “Staff should initiate efforts to ensure that the principles of this report are applied more consistently throughout the NRC.” There have been some developments recently regarding other risk-informed initiatives and so on, and you cite 1.200 in the standards and so on. The impression I'm getting is that the industry really doesn't -- considers those as they say the Cadillacs of the PRA, and there is no need for those things for risk-informed decisions. I don't need to have a PRA that meets 1.200. I don't need -- and I'm looking at this report and it goes into such detail, model uncertainty. You know, here are the EH, AB, DC that you have to worry about, and I'm wondering has anybody ever done that? Do we have a situation now where the PRA analysts are creating their own world when they talk -- where they talk about idealized PRAs that nobody who makes actual decisions uses them? I'm really disturbed by what I see, and I fully agree with the recommendation, but have you seen any study that actually comes close to

1.200? Or to what this report says? Or is it you, Dennis, and I who talk about these things?

JOHN STETKAR: I think you have to be really careful.

COMMISSIONER APOSTOLAKIS: I'm trying to be, but they won't let me.

[laughter]

In your experience, have you seen anybody do those things?

JOHN STETKAR: I've seen really good PRAs. Now, when you say -- I'm just going to leave it that way. I've seen really good PRAs out in the industry. Now, when you say a PRA, do I mean that every element of that PRA, whether you go to systems analysis or event sequence modeling or human reliability, data, internal events, external events, full power, low power, shutdown, you know, the whole scope of what you might think of as a PRA, are they all uniformly compliant with Reg Guide 1.200? No, they're not. They're not.

On the other hand, for risk-informed application for decision-making, because that's a tailored application, I think people have developed reasonably good quality PRAs for those particular focus applications.

COMMISSIONER APOSTOLAKIS: But the argument they make is that I don't have to meet your ANS/ASME standard for me to make good risk-informed decisions. And I'm thinking maybe they're right. Maybe we should revisit those standards. Maybe we are asking for too much that is not needed in an actual risk-informed application, but I don't like the idea of having the Commission say, “You should comply with the standards that are in force one year before whatever,” and then we turn around say oh, forget it, we're not going to do that. So either we change the standard or we develop some other

guidance that says what you said that for this particular application I don't need all the bells and whistles.

JOHN STETKAR: And that's what the guidance says.

COMMISSIONER APOSTOLAKIS: Which guidance is that?

JOHN STETKAR: Our guidance. The regulatory guidance. No, 1855 isn't a Reg guide. There are Reg guides for specific risk-informed applications. And in general, in general, ASME/ANS standards are not -- essentially nobody tries and it's not expected to reach capability category three across the board.

COMMISSIONER APOSTOLAKIS: Two. We're talking about category two.

JOHN STETKAR: Two. But two is not all that onerous.

COMMISSIONER APOSTOLAKIS: This is what confuses me.

JOHN STETKAR: Two is not all that onerous.

COMMISSIONER APOSTOLAKIS: I hear that they don't need that for the applications and I get very confused by that.

DENNIS BLEY: Could I add something, John?

COMMISSIONER APOSTOLAKIS: Yeah, of course.

DENNIS BLEY: When you read the standard it defines all that, but then it has a requirement to peer review the PRA. I've only seen a few peer reviews. I've heard some were very -- the ones I saw were extremely good. I've heard there are some that might not be as good, but the one I saw went through against all those requirements and evaluated all of the PRA, including the external events against every one of the requirements in the standard. And it graded it, and what they did was if they didn't fully meet it they defined the ways

in which it didn't, and sometimes they revised the PRA to bring it all the way up or they left it with those things identified. Now it has a section that tells you when you're going to do an application, you come in with the application against the PRA and if that application relies on areas of the PRA that weren't graded as high quality, then you've got to fix your PRA before you can use it.

COMMISSIONER APOSTOLAKIS: But you are taking the point of view of the PRA. I'm taking the point of view of the actual decisions. We issued an SRM recently that has to do with prioritization of regulatory actions and so on. It was a -- use the PRA. A PRA -- a voluntary rule. Use a PRA that meets the standards, and the industry comes back and says, “We don't need to do that. We can actually prioritize with a current state of PRA.” So, every step of the way when there are real decisions there is this revolt against the standards and that's what bothers me. I have one more question, but that's okay.

CHAIRMAN MACFARLANE: Okay. Well.

CHARLES BROWN: I don't know if I'm out of order, but could I amplify one of my responses to Commissioner Svinicki? That's something we neglected --

CHAIRMAN MACFARLANE: Sure, if you keep it brief.

CHARLES BROWN: It will be very brief.

CHAIRMAN MACFARLANE: We have another meeting after this, so --

CHARLES BROWN: It will be very brief. When I talked about control of access -- am I on?

CHAIRMAN MACFARLANE: No.

CHARLES BROWN: Oh, I turned it off. Apologize for that. I just

used up my time. When I talked about control of access I mentioned the cyber security rule, which was being argued or discussed by the staff, and I talked about control of access, another term. That is not a term invented by the committee. That has been around for decades. The 10 CFR50.55(A)(h) is the rule that implements the guidelines. IEEE standard 603-1991, which are the rules and requirements for designing instrumentation and control systems; it has a section which says control of access -- that the design shall permit administrative control of access to safety system equipment. It also says that these administrative controls shall be supported by provisions within the safety systems or the generating systems in the station design, or a combination thereof. And the point of contention is if you have a software-based external feed you've now seated control of data coming back into the plant externally to people outside the plant. Forget the reason for it. I mean, it could be as simple as somebody, a business guy updating something and all of the sudden flipping a bit and now it's a two-way -- it can be all kinds of things. But I didn't want to walk away with the thought that there is no rule applied. We did not invent this. It is part of the design as they presently stand, and so that's where the contention is.

CHAIRMAN MACFARLANE: Thank you.

CHARLES BROWN: Thank you.

CHAIRMAN MACFARLANE: Any other further comments from Commissioners?

[laughter]

COMMISSIONER APOSTOLAKIS: Many years ago, the ACRS asked the staff to try to identify potential failure modes of digital systems. Did you ever receive anything? Do you know what the failure modes -- I mean I'm

sure you do, but was there anything produced out of that?

CHARLES BROWN: There are -- they recognize that there's a wide range of ways that digital systems can fail. They didn't produce a list that I -- if you ask me to go find the list that somebody provided -- was that provided during your tenure or was it post-me getting here? I'm not sure which -- when that happened.

COMMISSIONER APOSTOLAKIS: We overlapped a lot. You should have seen it. It doesn't exist.

CHARLES BROWN: No. I have not -- I do not remember getting a specific list.

JOHN STETKAR: George, just one last comment on that. We do have a subcommittee meeting scheduled in September, I believe it is, that the staff and the industry is going to present to us something called a hazard analysis and failure modes identification. So, we are on schedule. We might hear something on that in the September timeframe.

COMMISSIONER APOSTOLAKIS: Glad to hear it. Thank you, Madam Chairman.

CHAIRMAN MACFARLANE: Okay. Everybody done? All right, great. Then we'll close this meeting. Thank you very much. I think it was a very productive discussion as usual. I learned a lot myself and I look forward to the next time, unfortunately without Dr. Shack, but we wish you very well. Thank you all. We're adjourned.

[Whereupon, the proceedings were concluded]