

UNITED STATES OF AMERICA
U.S. NUCLEAR REGULATORY COMMISSION
MEETING WITH THE ADVISORY COMMITTEE ON
REACTOR SAFEGUARDS (ACRS)

JUNE 7, 2012

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TRANSCRIPT OF PROCEEDINGS

Public Meeting

Before the U.S. Nuclear Regulatory Commission:

Gregory B. Jaczko, Chairman

Kristine L. Svinicki, Commissioner

George Apostolakis, Commissioner

William D. Magwood, IV, Commissioner

William C. Ostendorff, Commissioner

APPEARANCES

ACRS Members:

Dr. Sam Armijo, Chairman

Dr. Stephen P. Schultz

Dr. William J. Shack

Dr. Michael L. Corradini

1 PROCEEDINGS

2 CHAIRMAN JACZKO: Well, good morning everyone. We're here
3 to have our twice a year meeting with ACRS, and these are always very
4 interesting meetings. I think the Commission benefits greatly from the ACRS's
5 experience and their insights on a number of important issues and I've certainly
6 always appreciated their thoroughness and candor. Today's meeting we'll
7 discuss a number of important issues, including the Spent Fuel Pool Scoping
8 Study, the implementation of the Fukushima related lessons learned, the State-
9 of-the-Art Reactor Consequence Analyses Project, and the NRC Safety
10 Research Program. So, with that I'll turn it over to you, Sam.

11 DR. SAM ARMIJO: Thank you very much Mr. Chairman. First,
12 we'll go first to the overview.

13 ANNETTE VIETTI-COOK: I think you turned it off.

14 DR. SAM ARMIJO: Did I just turn it off? Okay, I'll try again. Thank
15 you very much, Mr. Chairman. We'll start with the overview. First slide.

16 Since our last meeting in November of last year we've issued 21
17 reports. The four key topics that we will be discussing are listed first. The spent
18 fuel scoping study, the draft 10 CFR 50.54(f) letter on implementation of near
19 term task force recommendations from the Fukushima Dai-ichi event; Dr. Schultz
20 will present that part. He will also cover the response to February 27th, 2012,
21 letter regarding the final disposition of Fukushima related ACRS
22 recommendations in our letters dated October 13th and November 8th, of 2011.
23 He'll also cover the ACRS review of the proposed orders in response to
24 Fukushima lessons learned, SECY-12-0025.

25 Dr. Shack will review the State-of-the-Art Reactor Consequence

1 Analyses, SOARCA Project, and Dr. Corradini will review the evaluation of the
2 NRC Safety Research Program, NUREG-1635.

3 We've also covered -- reported on the safety aspects of the
4 Progress Energy Florida, Inc., combined license application for Levy Nuclear
5 Plant's Units 1 and 2. Next slide.

6 Thank you for keeping up with me. The response to the January
7 24th, EDO letter regarding the Progress Energy combined license application for
8 Levy; the Chapters 6, 7, 15, and 18 of the Safety Evaluation Report with open
9 items associated with the Calvert Cliffs Nuclear Power Plant, Unit 3 combined
10 license application. Next slide.

11 And two have various Chapters 3, 9, 14, 19, 6, 7, 11, 13, 15, and
12 16, on the EPR. We're making -- we are, as you know, we are evaluating these
13 design certification applications as the chapters are completed so they can move
14 on to the next phase --Dr. Powers has been handling that -- will not, of course --
15 not available today. Next slide.

16 Next is the Final Safety Evaluation Report associated with the
17 Florida Power and Light Turkey Point Nuclear Plant, Units 3 and 4, license
18 amendment request for an extended power uprate; also, the report on the safety
19 aspects of the license renewal application for the Columbia Generating Station.
20 Next slide.

21 We've reviewed the proposed draft rule for 10 CFR 50.46, the
22 Emergency Core Cooling System Performance During Loss of Coolant
23 Accidents, an Extremely Low Probability of Rupture Project, and the draft final
24 NUREG-1921, EPRI, NRC Fire Human Reliability Analysis Guidelines. Next
25 slide.

1 We reviewed the proposed requirements for ITAAC maintenance
2 and draft, final regulatory guide 1.215, guidance for ITAAC closure under 10 CFR
3 Part 52. Also, we reviewed the revised branch technical position on
4 concentration averaging an encapsulation of low level radioactive waste. Next
5 slide.

6 Draft final revision. We've reviewed the draft final revision to
7 Regulatory Guide 1.93, availability of electric power sources and draft
8 Commission paper risk informed regulatory framework for new reactors. We've
9 also responded to an EDO letter dated October 28th, regarding the ACRS
10 recommendations on the topical report NEDC-33173P, supplement two, parts 1,
11 2, and 3, which is the analysis of gamma scan data and removal of safety limit
12 critical power ratio SLMCPR margin. Next slide.

13 In regard to new plant activities, we're currently reviewing the
14 design certification applications and safety evaluation reports associated with the
15 USEPR and the US-APWR designs. Also the adequacy of long term core
16 cooling approaches for the ABWR and the US-APWR, the reference combined
17 license applications for ABWR, ESBWR, US-APWR, and USEPR, and the
18 subsequent COLAs for the AP1000, and we're continuing to complete reviews of
19 this -- these various topics as the material becomes available.

20 In the future we expect to review the interim and final safety
21 evaluations for the Seabrook, South Texas, Limerick, Davis Besse, Callaway,
22 Diablo Canyon, and Crystal River Plants. Future power uprate applications, we'll
23 review Grand Gulf and St. Lucie 1 and 2, Crystal River, Browns Ferry 1, 2, and 3,
24 and Monticello extended power uprate applications.

25 In our spare time, we're also going to address these following

1 issues: Fukushima long term reviews on certainties and PRA; Watts Bar 2; fire
2 modeling applications; extended spent fuel storage and transportation; PWR
3 Sump Strainer Blockage; revisions to the construction at reactor oversight
4 process assessment program; revision of the 10 CFR Part 20, based on ICRP
5 recommendations; Level 3 PRA; and NFPA-805 license amendment request;
6 SMR, small modular reactor regulatory guidance; and other emerging technical
7 issues. And I believe that's all we have on the overview. I've tried to get through
8 quick to leave some time for questions. If that's okay, we just go right to the next
9 topic. Okay.

10 CHAIRMAN JACZKO: Yeah, we'll do all the questions at the end.

11 SAM ARMIJO: Okay, great. The next topic will be the Spent Fuel
12 Scoping Study, which SFPSS, and I'll handle that review. First slide.

13 The spent fuel safety has been addressed in prior NRC studies
14 starting in the '70's with consequent studies related to high density racks. In the
15 late 1980's in resolution of generic issue 82, beyond design basis accidents for
16 spent fuel pools, and in the 2000's related to post 9/11 security issues.

17 The frequency of events leading to significant damage to the pool
18 and uncovering of the fuel is very low, the order of six times 10 to the minus
19 seven, to two times 10 to the minus six, but the consequences would be large. If
20 there was drainage of the pool, fuel overheating, failure and uncontained release
21 of fission products, that was certainly made very dramatic during the Fukushima
22 events in which Unit 4 had a hydrogen explosion which could not be explained
23 readily and there was concern that the pools had drained and that something
24 was going on. We've since learned that that was not the cause of the explosion
25 of Unit 4, but the concern remained.

1 The Spent Fuel Study will update the earlier beyond design basis
2 accident consequence estimates, which were done in resolution to resolve
3 generic issue 82, and we'll reexamine the potential advantages associated with
4 expedited transfer of older fuel currently stored in spent fuel pools to dry cask
5 storage. This will be the first publicly available application of MELCOR in its
6 analysis of spent fuel pools, and it'll be the first assessment of this, of beyond
7 design basis accident where the availability of 50.54(hh) equipment is taken into
8 account. Next slide.

9 The past Spent Fuel Pool Risk Studies indicate that the seismic
10 hazard is the prominent contributor to the spent fuel pool uncovering. You can
11 cause damage by a heavy drop, heavy cask drop, but the dominant contributor is
12 seismic hazard. The Spent Fuel Pool Scoping Study which was begun last year,
13 in July of last year and will be completed shortly, I believe this month, will
14 evaluate this hazard, impact of this event on a pool with two conditions will be
15 considered. Current -- representative of current U.S. practice of high density
16 loading of pre-fuel pools and/or a low density loading in which all the older fuel
17 that can be moved would be moved to a dry cask storage. Next slide.

18 It's called a Scoping Study but it's a very impressive piece of work.
19 The study addresses key questions and provides insights on accident
20 progression, seismically induced station blackout scenarios, public health effects,
21 and the post event mitigation. Next slide.

22 In our letter the ACRS has stated that the study is very well
23 organized, very systematic, and is using modern NRC codes. It consists of a
24 detailed deterministic analysis of the consequences of a severe seismic event on
25 a BWR spent fuel pool. This was a BWR pool of a design very similar to that,

1 those pools at Fukushima. It will contribute to the technical basis for decision
2 making regarding expedited transfer.

3 We also noted that the elements of the study include a detailed
4 assessment of the pool and liner structural integrity following severe seismic
5 events. These are events up to six times greater than the site safe shutdown
6 earthquake, and the analysis will include dose rate determinations using the
7 SCALE code package. Next slide.

8 The analysis will follow the accident progression through fuel
9 damage, fission product release, and evaluate the benefits of mitigation during
10 this event, and will use a MELCOR code. It'll also assess emergency planning.
11 Next slide.

12 The elements of the study include the assessment of offsite
13 consequences and analysis of health effects and land contamination using the
14 MACCS2 code, and will include probabilistic considerations. Next slide.

15 We've concluded that the Spent Fuel Pool Scoping Study is
16 capable of producing quantitative assessments of the benefits of low density fuel
17 loading. We do caution that the overall safety benefit will not be quantified
18 without a comparable assessment of the safety consequences associated with
19 the alternative which includes processes involved in expedited loading, transfer,
20 and long term dry storage. Although the study is limited to one particular design,
21 it will provide valuable information and -- but additional work may be needed to
22 provide -- to come to general conclusions regarding the overall U.S. pools. I
23 think that's all I have, and I'll now turn it over to, I believe, Dr. Schultz.

24 DR. STEPHEN SCHULTZ: Thank you Sam. This presentation is --
25 section of the presentation is going to focus on the implementation of Fukushima

1 recommendations. As was indicated in the introduction, this represents a
2 substantial portion of the committee's activities over the past several months, and
3 I'm going to present this in reviewing three of the letters that we have provided as
4 information and guidance to the staff.

5 The recent ACRS reports on Fukushima that I will be describing
6 include a letter on February 15th, which looked at the draft 10 CFR 50.54(f) letter
7 on the implementation of the near term task force recommendations from the
8 Fukushima-Dai-ichi event. And on March 13th the committee provided to the
9 staff a response -- commented on a response associated with the staff's review
10 of the disposition of the Fukushima related ACRS recommendations in letters
11 which the committee provided to the staff in the fall of 2011. Next slide, please.

12 And on March 14th the ACRS performed a review of proposed
13 orders in response to Fukushima lessons learned, and we provided
14 recommendations to the staff at that time. Next slide, please.

15 The first letter that I referenced was associated, again, with that
16 draft 10 CFR 50.54(f) letter, and the condition and recommendation affects the
17 technical scope and consistency of the requested evaluations of seismic risk. In
18 particular, in the 10 CFR 50.54(f) letter, information was requested under the
19 near term task force recommendation 2.1, which referred to the guidance of four
20 seismic margin analyses and two -- with two references: one, NUREG/CR-4334,
21 on seismic margin analysis and referred specifically to part 10 of the ASME/ANS
22 guidance, as providing acceptable guidance to perform this analysis. Next slide,
23 please.

24 What the ACRS pointed out in the letter was that looking at the
25 objectives associated with response to the Fukushima accident issues and

1 responses, the goal was to be sure that the requirements that would be used
2 associated with the seismic hazard and vulnerability evaluations would use
3 current, applicable Commission requirements and guidance. Next slide, please.

4 Therefore, the committee commented that instead of citing Part 10
5 of the ASME/ANS guidance, Part 5 as it was endorsed by the interim staff
6 guidance associated with the applications for new reactors, Part 5 should have
7 been appropriate reference to match current guidance for this application. In
8 fact, in the interim staff guidance that was provided associated with the new
9 reactor application, there was a specific note describing Part 10 of the ASME
10 guidance indicating that they're not acceptable for performing at design specific
11 seismic margin analysis for a new reactor; and in that regard, the intention in that
12 application and as should be for the Fukushima applications, the guidance in Part
13 5 is more detailed than in Part 10, provides more interaction and relationship
14 between the PRA and the seismic margins analysis and would be a more
15 appropriate application.

16 Moving forward, in interactions with the staff related to this, we've
17 determined with the staff that moving forward with appropriate guidance on the
18 applications this should be brought forward to the industry.

19 With regard to the next letter, March 13th, 2012, this again was the
20 response to the disposition of the ACRS recommendations which were made last
21 fall and we pointed out two issues that we felt, again, continued to be important.
22 The first was a Tier 3 designation of additional hydrogen control and mitigation
23 measures for Mark I and II plants, which we felt was counter to the intent as near
24 term Defense-in-Depth measures, and the committee had recommended that this
25 should be in Tier 1 actions. So we commented back to the staff that we felt the

1 classification of this should have had a higher priority. Next slide, please.

2 Also, classified in Tier 3 was a designation of the fire response
3 procedures and we felt, again, that the fire response procedures should be part
4 of Recommendation 8, which handles these issues and the fire response
5 procedures should be incorporated at a higher level of focus. It presents similar
6 challenges as those faced by the integration of the Cirex management guidelines
7 and the EEMGs with the EOPs.

8 As we've interacted with the staff on these issues, again moving
9 forward with the Tier 3 guidelines, we've started reviewing the implementation of
10 those by the staff and we're going to put additional emphasis on these two
11 measures as we feel it's appropriate and we're looking for the staff to provide for
12 themselves feedback of information from these two Tier 3 items into the Tier 1
13 issues as they move forward. Next slide, please.

14 The last letter was published on March 14th, and was a review of
15 the three proposed orders regarding the development strategies to mitigate
16 beyond design based natural phenomenon, the installation of reliable hardened
17 vents for BWRs with Mark I and II containments, and the installation of enhanced
18 fuel pool instrumentation. Next slide.

19 The recommendations are on the next few slides. The first was a
20 recommendation for clarification on the technical basis, which was provided in
21 the guidance, in the order providing venting capacity equivalent to 1 percent of
22 the license rated thermopower. This was provided in the order. Particular
23 clarification or supporting information for this particular choice was not provided.
24 Again moving forward, we're expecting that in the staff guidance that is going to
25 be provided, this will be clarified.

1 The next recommendation on the next slide was that a recognition
2 really that the containment venting systems that are being put in place should be
3 treated in similar manner as other systems, if the seismic flooding and other
4 natural external hazard reevaluations indicate an increase in the hazard level.
5 This is a matter of order. In other words, design and implementation of the
6 system modifications or changes will be done and may be done before the
7 reevaluations have been fully complete, and the recommendation is to recognize
8 that these systems should be treated and, if necessary, given the new
9 information they should be addressed as other plant systems would be.

10 The next item is for clarification again, that the language was not
11 clear in the order whether operating procedures must be modified to integrate the
12 use of instrumentation for response to abnormal spent fuel pool level conditions.
13 Again, it's a matter of clarification that in the guidance going forward can be
14 clarified. Next slide.

15 The next item is similar to one I've described related to how we
16 follow up when the reevaluations of external hazards is complete. The FLEX
17 approach appears responsive to mitigation strategies for the beyond design basis
18 external events. It doesn't eliminate the potential for follow up regulatory actions
19 as a result of these reevaluations, and a very important clarification for the
20 industry. Future activities related to the NTTF Tier 1 Recommendation 8, on the
21 integration off-site emergency response capabilities will impact procedures,
22 guidance, and training requirements associated with these orders. One would
23 think that this would be an obvious conclusion, why we mention it is the
24 importance that the development of the procedures, guidance, and training will
25 have in moving forward with implementation, and also the magnitude of effort

1 that will need to be applied to the procedural integration and the training
2 associated with the implementation of these orders. Thank you.

3 DR. WILLIAM SHACK: I'd like to discuss the State-of-the-Art
4 Reactor Consequence Analyses, SOARCA Project. Next slide, please.

5 This is basically our final review of the SOARCA Project. We've
6 looked at it over the years. I think that we will agree that SOARCA work is a
7 major step forward in developing more realistic inter-rule deterministic analyses.
8 These techniques will be -- could be useful, for example, to examine more
9 important scenarios that you identify when we're moving on with level three
10 PRAs. The insights that you get from accident progression and source terms, I
11 think, are helpful in providing a general insight into the reactor behavior during
12 severe accidents.

13 We felt that the highest priority work should be the development of
14 going on with SOARCA, with Surry uncertainty analysis in a MACCS best
15 practices document. This will complement the ongoing effort that was put
16 together to get a best practices MELCOR document, and an uncertainty analysis
17 of the Peach Bottom. And, again, this is perhaps a knowledge capture thing and
18 one can look almost at MELCOR itself as a kind of a compendium knowledge
19 capture of everything that we've tried to learn about severe accidents.

20 The best practices document try to transfer that knowledge that's
21 sort of been developed over the years and developing in SOARCA and actually
22 how to use the code and make some of the modeling choices. And, again, we
23 think capturing that knowledge in this best practices document is important for
24 MELCOR and for MACCS. And, again, MELCOR tries to codify our best
25 understanding of severe accident behavior, but it's also important to have a good

1 understanding of its uncertainties and limitations; and, again, documenting that
2 from the experts who've developed SOARCA I think will give insight for people
3 who may be trying to use this in the future in developing understanding.

4 There's always some discussion within the committee of how to describe a
5 SOARCA analysis. Is it a best estimate analysis, a more realistic analysis, a
6 realistic analysis? I'm going to refer to them as best estimate analyses because
7 that strikes me as a fairly value neutral kind of, you know, it, you can do
8 benchmark calculations to determine whether it's realistic or not, but it certainly is
9 -- represents our best estimate of how these progressions go. One of the things
10 that we did, you know, that the SOARCA provided a best-estimate analysis and
11 published a document NUREG-1935, before the Peach Bottom uncertainty
12 analysis was completed.

13 And I think that we're finding that as you go through the -- you
14 know, they did a number of sensitivity studies and uncertainty analyses as they
15 were developing 1935, but a more exhaustive and pertinent review of the
16 uncertainty analysis could indicate that there are some things that may change
17 about that. So we think that this further illustrates the need that you carry out
18 your uncertainty analysis and your best-estimate analysis together, that they're
19 not a sequential sort of thing, that you do something and then you paste on an
20 uncertainty analysis at the end. Next slide, please.

21 Now, SOARCA gives you a very good understanding of some
22 particular scenarios, some very definite scenarios, but again, in the scenarios
23 that are selected are clearly important contributors to risk, that have been
24 identified as important contributors to risk in many PRAs. But again, even for the
25 two plants that we've looked at, the total fraction of the risk captured is not

1 known. Exactly how it corresponds to different plants would be, again,
2 something that really isn't known, and isn't known until you've done a more
3 complete extended Level 3 PRA.

4 Again, I think they're trying to do a very good job on the uncertainty
5 analysis. It includes parameter uncertainty, sensitivity studies. Understanding
6 uncertainty is important. And again, parameterization of uncertainty is a good
7 way to quantify uncertainty, but we can't -- we don't know enough to parametrize
8 or quantify all risks and therefore, again, these should be complemented with
9 sensitivity studies to try to essentially understand whether our uncertainties that
10 we can't quantify very well are going to impact our results. And again, one of the
11 things that we see needed in the further completion of the uncertainty analysis is
12 a good justification for the selection and admission of parameters of interest that
13 they have chosen.

14 And going forward, it would be nice to carry out a SOARCA type
15 analysis on an ice condenser containment. However, we feel that if resources
16 are constrained, that the priority should be given to the completion of the Level 3
17 analysis PRA studies that are currently underway. Next slide, please.

18 I should note that SOARCA benefited greatly from the peer review.
19 I think that the peer reviewers made many comments that were similar to those
20 that the ACRS had in its initial review of SOARCA. But because they're peer
21 reviewers, they were able to keep at it, and work on them harder, and I think that
22 the SOARCA people benefited from that advice and -- again, one of the things
23 that we get out of SOARCA -- again, we've known for a long time that if you
24 looked at some of the early consequence studies, the Sandia studies, the source
25 terms in there were really overly conservative in terms of the magnitude and the

1 timing of the release.

2 And you know, we've known that sort of qualitatively, we've known
3 that we have a better understanding now of source terms, containment behavior.
4 SOARCA provides a real quantification of the kind of difference that that makes,
5 at least for the scenarios that we've looked at. And again, there's always that
6 limitation that we've only looked at some certain selected scenarios, but they
7 provide a better -- a quantification of the slower progression that we expect, the
8 more realistic containment behavior, the potential benefits of the SAMGs, the
9 mitigating guidelines that we've used. And if you're successful in deploying it, the
10 equipment associated with the 54(hh) can mitigate some of the scenarios.
11 Again, even within SOARCA, it couldn't mitigate all the scenarios that move too
12 quickly to essentially bring in this portable equipment. But a number of the
13 scenarios could be mitigated with successful use of the 50.54 (hh) equipment.
14 Next slide, please.

15 When we went on to the consequence analysis, one of the things
16 that we did like was that the consequence analysis did include seismic effects on
17 local infrastructure, and which we felt was essential to get a more realistic
18 estimate of the effectiveness of evacuation. And again, even with consideration
19 of those effects of evacuation, together with a slower progression showed that,
20 you know, it could be very effective and essentially there was no risk of early
21 fatalities even for the unmitigated scenarios that you couldn't mitigate with your
22 50.54(hh) equipment.

23 Again, for the scenarios considered, not only no risk of early
24 fatalities but the latent health effects from any of the dose response models,
25 whether, again there was a fair amount of controversy over whether you should

1 use linear, no threshold or the, you know, the classical strictly linear models. But
2 again, they were all small compared to the safety goals. One interesting thing
3 was that they were typically dominated by the doses people received returning
4 home in accordance with the guidelines established by the state authorities. And
5 so it's essentially the health effects were sort of within your control by looking at
6 those guidelines. Next slide.

7 Again, we think that there are important insights into the outcome of
8 a scenario, but again, we have to go through the uncertainty analysis to
9 understand the impact that the uncertainties may have on the outcomes. The
10 formal methodology of the uncertainty analysis is rigorous, and, again, the
11 important thing is to look through the processes for choosing the parameters and
12 the ranges and distributions of the parameters that are used in that uncertainty
13 analysis are less well developed. Again, that's why we think that it's important to
14 continue work on these uncertainty reports for the Peach Bottom and the Surry
15 analyses. Next slide, please.

16 Again, as I mentioned, not all these uncertainties can be
17 characterized by parameter uncertainties and you really need to look at
18 sensitivity studies to still handle some of the additional uncertainties. Next slide,
19 please.

20 Coming back, the SOARCA people set up a fairly systematic way to
21 look at internal events, but then when they looked at their two particular
22 situations it turned out that the external event scenarios appeared to be the ones
23 most likely to give you considerations of real risk. And again, those scenarios
24 and the estimated frequencies of those scenarios were not based on rigorous
25 PRAs. They were based on expert judgment, developed from much earlier PRAs

1 done for 1150 -- you know, 20, 30 years ago. And again, without more complete
2 external events PRAs, it's not clear just what fraction of the risk has been
3 captured, although we do understand the behavior of the particular scenarios
4 well.

5 And because of that -- next slide, please -- the comparisons with
6 the earlier studies such as the Sandia consequence report should not be made
7 without acknowledging the differences in limitations that we've made in these
8 analyses. And again, final sort of thing is that we really want to document this.
9 There's been a tremendous technical effort here. We need to capture that effort
10 in these reports on the uncertainty analyses in the MACCS best practices report.
11 And that's all I have to say.

12 CHAIRMAN JACZKO: I think there was no uncertainty about what
13 your concerns were. [laughs] Mike?

14 DR. MICHAEL CORRADINI: Good, thank you. So, we'll take a few
15 minutes and just give you a quick overview of our report on the safety research
16 program. Could I have the next slide, please? Thank you.

17 So, as you probably all know, but just to review, the scope is really
18 the current safety research program organized by the Office of Nuclear
19 Regulatory Research. This year we chose -- or I should say this -- in our two-
20 year rotation, we chose to focus on safety research and the aftermaths of the
21 events at Fukushima Dai-ichi -- I'll come back to that -- and, as usual, we do not
22 discuss or review research on security and safeguards. Next slide, please.

23 Just some general observations. The current safety research
24 program is really quite closely tied to the needs of line organizations. As you all
25 know, there is a small amount of long-term research, a percent or so, of the

1 budget, but by and large about two-thirds of it is in support of line organizations
2 and their needs, developed by user needs, and about a third for mandated
3 programs. From our standpoint, we've done this and I'm new to the -- being in
4 charge of the reviews, so the technical expert is off having fun somewhere. I'm
5 not sure where.

6 But we have said in the past, and I think we continue to feel the
7 research activities are delivering useful products to the line organizations in a
8 very timely manner. As we've done in the past, we've chosen to take the
9 individual areas and break them out to about a baker's dozen of areas, which are
10 in the meat of the report. I know that many of you have read it or have looked at
11 pieces of it that interest you and we can go back to that in your questions. I'm
12 going to try to hit the highlights. Next slide, please.

13 So I'd like to talk about collaborations in the conduct of research.
14 RES has always and continues to take advantage of opportunities to leverage its
15 resources and expertise on issues, and look for areas of common interest to
16 work with other Federal agencies, industrial organizations, international partners.
17 I have two examples that I've listed here. The fire research, which is with NIST
18 and industry, and if I just take a minute and talk about the Fukushima analysis,
19 this is quite unique, given the uniqueness of the events as they occurred.

20 Department of Energy in collaboration with the NRC had done a
21 good deal of work in kind of a reconstruction analysis of the accident, trying to
22 understand things in detail. This involved EPRI, this involved laboratories,
23 universities and it's ongoing. I should say also the IAEA. Just as one special
24 note, one of our members, Dr. Rempe was intimately involved in this -- in fact,
25 was invited to go to the IAEA in Vienna and give a paper that discussed a lot of

1 this analysis and actually hearkened back to the similarities and differences to
2 TMI, and I think this is of special note. Next slide, please.

3 I'm going to take a minute to talk about areas deserving some
4 special attention in the future. I think this was -- many of you know there's
5 growing emphasis on the use of numerical simulation to resolve reactor safety
6 issues. Recently the industry has shown intent to use these tools, such as
7 computational fluid dynamics and thermohydraulic safety analysis. And even
8 going further than this, many of you are aware that the Department of Energy has
9 awarded to a team of laboratories and universities with industrial collaboration,
10 work in -- essentially, we'll call high fidelity computational simulation. Many of the
11 issues they're looking at are not safety issues, they're operational issues to
12 increase capacity factor, keep the plants online.

13 But some have and will evolve into safety issues, and over the long
14 term, we really feel the NRC needs to be in a position to evaluate products of
15 these simulations. There's a number of reasons. One, at least from my
16 background, is really to maintain the human resource in terms of internal
17 expertise to understand what is presented to them, what are the limitations of it,
18 what needs to be validated, what needs to be verified. So I think it's very
19 important that the staff pay attention to what's going on, prepare themselves
20 relative to staff training and ability to understand these tools and use these tools.
21 Next slide.

22 A natural lead-in from this really is the adequacy of experimental
23 facilities. If I go away from this current long-term process of high-fidelity
24 simulation and only go back into the things that we consider in terms of safety
25 issues relative, for example, EPU's, there is a natural lead-in to the need for

1 additional data to validate the models that are used, even if the models are best-
2 estimate models with uncertainty. So you need additional data to validate, to
3 verify the calculational tools. That implies that you have to have experimental
4 facilities to essentially do these experiments, and, as you all are aware, the
5 experimental facilities in the United States aren't increasing.

6 Therefore, we really recognize -- we must recognize our growing
7 dependency on the experimental facilities in the rest of the world. So we really
8 feel it's important that these facilities remain available to the NRC through both
9 formal and informal collaborations.

10 I will say that this has been a theme in our research reports two
11 years ago, four years ago, and so in some sense we're repeating it. But I think
12 we repeat it because of how important it is. And to the credit of RES they've
13 really shown leadership here trying to engage in international collaborations,
14 whether they be informal or formal, to have these facilities available.

15 One example, which I'll try to connect up later when we talk about
16 Fukushima Dai-ichi, in the area of hydrogen, there are experiments ongoing now
17 in Europe and the Thai facility that NRC is part of, trying to understand the data
18 there, in terms of hydrogen mixing and transport. And we feel the NRC should
19 continue to develop these proactive strategies to ensure access to such facilities
20 in the future. Next slide, please.

21 Finally, the last reason, again, maybe I'm just the academic here. I
22 really do feel that in some sense you have to maintain the expertise and train the
23 new folks coming into the agency, particularly into RES, and one consideration
24 might be the NRC should consider assignments for some of the new staff for
25 essentially at some of these facilities so they understand the -- I was going to use

1 the word "joy," -- the fun of doing experiments, the uncertainty in the data
2 collected and how it's used and how it should be used. Next slide.

3 So the last thing I want to talk about is one particular topic of safety
4 research relative in the -- I'll call it safety research post-Fukushima. RES already
5 now is developing an integrated plan to obtain necessary technical bases for
6 implementing lessons learned. I want to just to go through about five areas, give
7 you a few examples and then I'll conclude.

8 In the area of protection from external hazards, we have in a
9 number of letters -- Steve actually has mentioned them in terms of our three
10 letters for Fukushima, but just to return to it, that we really feel there should be a
11 risk informed approach for extreme natural phenomena. We, in our report,
12 mentioned essentially, for example, flooding phenomenon in coastal areas where
13 design basis events are one way to do it, but you may want to consider going
14 beyond design basis events, consider a risk informed approach to look at where
15 the cliff is beyond that so that we have a full evaluation of what we may have to
16 consider.

17 In the area of protection from severe accidents, I guess I wanted to
18 kind of hearken back to one example, which is hydrogen control. In some sense,
19 the staff has already -- we were just presented this meeting some work on Tier 3
20 and what they're considering, and we're actually considering in a letter for Tier 3,
21 but already there the staff has already considered areas of hydrogen control in
22 terms of sources, timing, release pathways out of the primary system into
23 containment, from the containment possibly in leakage past to other buildings, as
24 well as possible control strategies. So I think research has a lot to bring to bear
25 in this in terms of using the tools they have, the experimental work they already

1 have that have developed the tools to help inform and evaluate and analyze what
2 staff will need in terms of hydrogen control. Next slide, please.

3 In the area of emergency response and severe accident
4 management capabilities, it's pretty clear we're moving from voluntary actions to
5 what I'll call mandatory areas in terms of EOP SAMGs and how they're
6 connected. Here, I think, research really can be a real help in evaluating and
7 providing tools for advanced training, all right? And, one example -- actually I'll
8 just use what Bill has said in terms of SOARCA, the work done with MELCORE
9 and MACCS can be used in some senses in an advisory training tool in terms of
10 scenarios as they develop training for the operators in terms of more regular or
11 consistent SAMGs from the various reactors. So we think there that research
12 can really be a good bit of help.

13 In the area of accident instrumentation to characterize plant
14 response, already there's a lot of instrumentation measuring temperature,
15 pressures, levels, radiation levels. But we think that here, again, research can be
16 used to essentially reverse and sometimes do it a bit backwards to the extent
17 that you're training the operators in terms of SAMGs. You want to think of the
18 critical set of instrumentation that you'll need to properly connect to the training
19 and procedures and then verify and be very clear as to what the design base
20 should be for those critical set of instrumentation that may have to be added or
21 made more robust.

22 Finally, in the area of improved understanding of severe accident
23 phenomena, NRC is already -- and I think I mentioned it before when I talked
24 about the international efforts, NRC already is working with DOE and the
25 international community. In some sense to deconstruct what happened at the

1 event, to look for evidence of accident progression. In some sense you want to
2 collect essential data so that you can decide what you're essentially calculating
3 actually makes some sense or if there's something that you've discovered that
4 actually tells you things aren't as bad as you would have computed, then you can
5 actually inform and improve those models.

6 And then finally, we felt that RES really should continue to work
7 with you in these areas, and as we understand it, that is under discussion and
8 current work to gain the insights and improve those models. So with that, I'll
9 stop. Thank you.

10 CHAIRMAN JACZKO: Thank you. Any wrap up? Okay, great.
11 We'll start with Commissioner Apostolakis.

12 COMMISSIONER APOSTOLAKIS: Thank you, Mr. Chairman.
13 First, I read the committee's report on the scoping studies, spent fuel pool
14 scoping study, and the added comments by four members, and I'm just curious.
15 Why were the added comments -- I mean why did the rest of the committee not
16 agree? I mean they don't really say anything, they just say "Go and look at the
17 various spent fuel pools and see what you learn from them," and I'm a little
18 puzzled.

19 DR. SAM ARMIJO: In the course of the give and take, apparently
20 we didn't make as good an argument --

21 COMMISSIONER APOSTOLAKIS: Is your microphone on?

22 SAM ARMIJO: Okay, in the course of the give and take of our
23 discussions, we apparently didn't make as good enough persuasive arguments
24 to get the committee to agree, but, you know, the added comments are, as you
25 say, they're just additions. They're not anything that's critical of the letter itself.

1 We believe they're important --

2 COMMISSIONER APOSTOLAKIS: I understand that. It's just that
3 all it says is, "Go and see what you can learn from other real incidents," and I
4 was surprised that the majority did not go along. Anyway, you are one of the
5 authors, so maybe you're not the best person to tell me why?

6 DR. SAM ARMIJO: Yes.

7 COMMISSIONER APOSTOLAKIS: Dr. Shack, you have a
8 comment? You don't have to.

9 DR. WILLIAM SHACK: I think that what we are -- I think we would
10 agree that you should examine other instances. It's the trying to avoid to draw
11 conclusions from a limited set of data, is what the concern perhaps was.

12 COMMISSIONER APOSTOLAKIS: Yeah, but --

13 DR. SAM ARMIJO: Now I remember one of the arguments, and
14 one of the arguments was, look, the seismic events were really within the seismic
15 design basis. So, you can't learn a great deal. They worked like they were
16 supposed to work, and so don't make a big deal of it. That, I'm just
17 paraphrasing, that was sort of an argument, and but, you know, we don't always
18 agree on everything.

19 COMMISSIONER APOSTOLAKIS: I know, I know. Coming to the
20 research report, there are many recommendations in the report, and the report
21 praises some groups within the agency, like NMSS and the human factors
22 people, for prioritizing their research needs. What is missing, it seems to me, is
23 the overall prioritization of the recommendations of the committee. I know that
24 the issue was discussed years ago and there was a decision that this is really a
25 management decision, NRC management, but still though, seems you are

1 impressed by the efforts of individual groups to prioritize, why didn't you try to
2 prioritize your recommendations, or if you feel it's a management responsibility,
3 why don't you then push management to do that, and you express some views
4 then on what management says?

5 DR. SAM ARMIJO: We do list -- as you participated in the writing
6 yourself, we bring what we think are the most important recommendations from
7 the selected chapters forward, and that's our way of telling you what we think is
8 the highest priority, but we don't numerically rank them.

9 COMMISSIONER APOSTOLAKIS: But the committee does use a
10 more formal method for identifying the quality of research projects, when you are
11 more formal there, and I'm just -- it's just a suggestion. I mean if you want to
12 consider next time, then --

13 DR. MICHAEL CORRADINI: I think it's a good suggestion.
14 Management is here, so you can ask RES if they would invite and appreciate that
15 sort of thing.

16 COMMISSIONER APOSTOLAKIS: They have their own time, Dr.
17 Corradini [inaudible] --

18 [laughter]

19 COMMISSIONER APOSTOLAKIS: Now you are sitting at the table
20 --

21 DR. MICHAEL CORRADINI: Simply a suggestion.

22 COMMISSIONER APOSTOLAKIS: Another thing, there is a
23 recurring theme in the report, that I'm certain it should be quantified here,
24 uncertainties there, and so on. In Dr. Shack's presentation, he made it clear in
25 two of his slides that when the committee says uncertainty it should include

1 sensitivity studies. The research report doesn't do that, as far as I can tell. I
2 mean maybe you say it somewhere, but I didn't see -- and I think sensitivity
3 studies are really a very important part of the analysis, at least in some projects,
4 like, you know, seismic risk, and all that. So, again, another friendly suggestion,
5 maybe you can take more time on sensitivity --

6 DR. MICHAEL CORRADINI: That's a very friendly suggestion --

7 COMMISSIONER APOSTOLAKIS: -- but here is the question.

8 DR. MICHAEL CORRADINI: Yes.

9 COMMISSIONER APOSTOLAKIS: We keep talking about
10 uncertainties. Do we know what to do with them? I mean the only place I can
11 think of where there is some guidance how to -- what to do with the uncertainties,
12 is Regulatory Guide 1174 that says, you know, use the mean value, but then if
13 you are close to the boundary, then there will be increased management
14 attention. So, are we happy with that? Is it inherently a subjective decision and
15 we should leave it at that? I mean we always say quantify the uncertainties.
16 What are the uncertainties? SOARCA didn't do them at the same time as the
17 best estimate. Are we happy with the way we are managing them afterwards?

18 DR. MICHAEL CORRADINI: So, are you --

19 COMMISSIONER APOSTOLAKIS: Maybe we are. I don't know. I
20 just want to ask the question.

21 DR. MICHAEL CORRADINI: Is that a -- you're looking to
22 somebody to answer that question?

23 COMMISSIONER APOSTOLAKIS: It's for everybody. Maybe the
24 PRA experts in the back.

25 DR. MICHAEL CORRADINI: The experts might be able to -- but, I'll

1 try, and then I'll turn to the experts. I guess though, at least in thermal hydraulics
2 I can give you a potential response, and see if you like it. It seems to me, at least
3 if I was away from a regulatory licensing decision, when I have an uncertainty, I
4 would test, model, test, model. I would essentially go through a series of
5 iterations to try to understand it better.

6 So, if I were to take an example, which I think the committee has
7 already -- is still in the middle of, so I can't give you a conclusion on it, as GSI
8 191, in terms of downstream effects. We're looking at some of the new
9 information and we see some of the modeling of that information, and we have
10 questions, and we've suggested, gee, you might want to go back and do a few
11 more experiments to understand what that uncertainty is. Is it really bounded by
12 the data that we currently see? So, at least in certain areas, I would say that's
13 the thing. If I'm now at a point where I only have a calculation to do and I want to
14 understand the spread of the calculation, then it would have to be, at least if it
15 were just me in charge, I would probably do a sensitivity to look around, to see if
16 I've done the uncertainty band, and I do a sensitivity that I know clearly is bound,
17 and if it's outside of it, then I can make some sort of informed judgment of where
18 I come down in terms of a decision.

19 COMMISSIONER APOSTOLAKIS: So, what you're saying is that -
20 - first of all, you are assuming that that's what our managers do too --

21 DR. MICHAEL CORRADINI: I'm sure they do.

22 COMMISSIONER APOSTOLAKIS: And this is good enough?

23 DR. MICHAEL CORRADINI: Under certain circumstances, I say it
24 is. Under others, and I gave you one example, you might decide that I can't
25 make a decision, go back and test, go back and --

1 COMMISSIONER APOSTOLAKIS: With the luxury of time, or you
2 may decide to invoke Defense-in-Depth and put extra barrier.

3 DR. MICHAEL CORRADINI: Correct, absolutely. In fact, if I might
4 just finish it, because I think you're right. I mean the staff, at least with my
5 example, has taken what I view personally as a conservative approach in terms
6 of downstream effects and have developed a criteria, which they feel very
7 comfortable with, so that if they continue to do testing, they'll determine there's a
8 margin there.

9 COMMISSIONER APOSTOLAKIS: In reading the chapter on
10 Digital I&C, on two pages, there is a mention of failure modes, and effects
11 analysis, and I have two questions. One is that the text seems to tie a failure
12 modes, and effects analysis to PRA, and I don't understand that. I don't need to
13 do a PRA, I do need to understand how the digital I&C fails, and --

14 DR. SAM ARMIJO: Commissioner, I don't want to interrupt --

15 COMMISSIONER APOSTOLAKIS: Go ahead.

16 DR. ARMIJO: -- the right person to answer that is John Stetkar, I
17 think is --

18 COMMISSIONER APOSTOLAKIS: Stetkar or Charlie --

19 DR. SAM ARMIJO: Charlie is not here.

20 DR. MICHAEL CORRADINI: Charlie is here.

21 DR. SAM ARMIJO: Oh, he made it, great. Well, we've got him
22 here. Thank you. I didn't see him come in.

23 CHAIRMAN JACZKO: Come to the microphone.

24 COMMISSIONER APOSTOLAKIS: Well, I do understand that the
25 systems we're using are very simple, the actuation systems. So, maybe it's not

1 such a big deal understanding the failure modes, but the committee did raise that
2 issue years ago, and we're still saying we don't understand it, Mr. Brown?

3 CHARLES BROWN: No, it's a matter of just considering it when
4 we're starting to look at some of the methods of operation of the Digital I&C.
5 We're trying to figure out a way -- how do you look through this thing and try to
6 quantify some of the decisions we make relative to the Defense-in-Depth, relative
7 to the redundancy we have, relative to the responses, and then looking at the
8 varying level of complexity, because the simplification, we'd like to see simpler
9 systems, but you need some way to evaluate what these things do in each of the
10 divisions, and how they affect each other

11 COMMISSIONER APOSTOLAKIS: But has there been any
12 progress? You say you are trying to understand. Are we still trying?

13 CHARLES BROWN: Well, the software end of the thing is very
14 difficult. Nobody knows how to do a software FME right now. I mean how do
15 you evaluate software relative to its various failure modes? That's one of the
16 points that has been made at a number of the discussions with the staff. We
17 don't have many answers on that.

18 COMMISSIONER APOSTOLAKIS: But in actuation, for example,
19 what if you have a premature actuation? I mean do people look at things like
20 that? I mean you don't have a very sophisticated or --

21 CHARLES BROWN: Yes. People look at specific premature
22 actuations, but how do you put them in to an overall organized standpoint, to see
23 how those respond? You can pick certain circumstances which seem to be
24 obvious based on what operators do or how the system operates, but how do
25 you put it in a manner where it can be more quantifiably evaluated?

1 COMMISSIONER APOSTOLAKIS: Anyway, the impression I got
2 from the report is that we're still trying, and you are saying no, we are doing
3 things.

4 CHARLES BROWN: Limited.

5 COMMISSIONER APOSTOLAKIS: Okay. I like your suggestion
6 that NRC Regional offices share responsibility for the maintenance of SPAR
7 models, and then I saw the response from the staff that said, "No, we don't want
8 to do that." I think it's a good idea. It eases the burden on whoever is
9 maintaining them now, but also it's a great way of bringing the regional staff up to
10 speed as to what the SPAR models can do, what they cannot do, and all that.
11 Any comments? Obviously you like the idea, I mean, I'm just saying that I was a
12 little surprised that the staff felt that they didn't want to do that, and on that happy
13 note, thank you, Mr. Chairman.

14 CHAIRMAN JACZKO: Sure. Commissioner Magwood?

15 COMMISSIONER MAGWOOD: Good morning. Pleasure to have
16 all of you with us today, on this week we celebrate the Queen's Diamond Jubilee.
17 Also, Commissioner Ostendorff, I know you're a submariner, and not an Airedale,
18 but this also marks the 70th anniversary of the Battle of Midway, which is a
19 significant event in U.S. Naval history. So, if there are any veterans that are
20 listening who remember those days? Thank you and congratulations, and
21 congratulations to the Queen for having the same job for 60 years, something I
22 can't imagine doing, but good for her.

23 Sam, I wanted to start with you, just a few more general things to
24 begin with. On your slide 16, you list all of the things that are going on right now,
25 things facing the committee. I remember conversations with the committee in

1 previous meetings last year or so, when we were going through the COL related
2 actions and design certifications, and it seemed like a large amount of work, and
3 the committee was doing a fantastic job to keep up with all of that, and I
4 remember thinking at the time, well, we'll be through a lot of this soon, and then it
5 will calm down, and the committee will have a more measured pace. It hasn't
6 quite worked out that way. So, were do we find ourselves? Are we reaching a
7 saturation point with the committee? Is the committee handling the workload
8 well? Are there issues that we should be aware of?

9 DR. SAM ARMIJO: Well, we're very fortunate. We have a very
10 strong team of people, very hard working. Staff has been very, very cooperative
11 in trying to meet our schedules. We've also been flexible. Right now, I think
12 we're handling the work. It's coming in slower in some cases. There's been
13 some delays, which fortunately help us a little bit, not necessarily, maybe not
14 good for the licensees, but that's not our problem. So, actually the work is -- I
15 think it's very manageable and, so we're -- if we start sinking, we'll ask for help
16 before we go under for the third time.

17 COMMISSIONER MAGWOOD: Sort of along the same lines, I
18 noticed that there were some periods over the last four months or so, where
19 there seemed to be slight schedule -- how do I put it -- schedule inconveniences
20 between the pace that we were setting on some of the Fukushima items and the
21 time that the committee had to review items, and write their letters. The past is
22 the past, but going forward, do we have any issues like that, that you think are
23 emerging, things you're concerned about from a schedule standpoint?

24 DR. SAM ARMIJO: No, I don't think so. I think we were feeling
25 that we were playing catch up. The boat had left and we're here. We're

1 reviewing a document that already -- the Commission had to get out, but I really
2 don't see ourselves in that situation now. Now, we're getting more into the
3 applications, to evaluation of the information that's coming back, and the staff's
4 decision on what to do. I think it's -- we'll probably still be pressed, but we won't
5 be as, you know, in the same state as we were during the initial phases of the
6 Fukushima actions.

7 COMMISSIONER MAGWOOD: Okay. Great, I'm glad to hear that.
8 Dr. Shack and his discussion about the -- when he was talking about the use of
9 the MACCS code, mentioned that in looking at SOARCA, the staff had included
10 in the MACCS analysis impacts on local infrastructure, because we were using
11 seismic events as the initiating event, and I know that we're using MACCS in the
12 spent fuel scoping study as well, but I haven't heard much discussion about the
13 effects on local infrastructure from the seismic event, this being postulated, and
14 obviously the reason that comes to mind is you're postulating a very, very large
15 seismic event, and I've asked the staff this. Haven't really got a clear answer. I
16 want to see your views about this.

17 What, you know, if you're having a once in 60 year or a 100,000
18 year earthquake, you know, life isn't normal outside the plant. It's not normal on
19 the plant either, for that matter. How are we dealing with that in this analysis?
20 Now, are we taking those things into account in a logical fashion?

21 DR. SAM ARMIJO: We haven't reviewed the results of the spent
22 fuel scoping study, yet. We have reviewed the approaches, and that's what we
23 commented on. We did get a glimpse at some very preliminary work, and I'm
24 afraid we didn't get into whether the MACCS analysis that had been done, I'm
25 not even sure it was actually reported to. So, we don't know.

1 COMMISSIONER MAGWOOD: Okay, so you just know you're
2 using MACCS, but you don't what's been done with it.

3 DR. SAM ARMIJO: We know the staff's going to use MACCS. So,
4 I can't tell you what their -- we look forward. It's -- the study's supposed to be
5 done this month, and so we look forward to reviewing that.

6 COMMISSIONER MAGWOOD: I think that we are all interested in
7 seeing it. Just one more thing about the spent fuel scoping study, you mentioned
8 that the staff did not choose to evaluate the safety consequences associated with
9 the expedited loading transfer of spent fuel from the pools to long term storage. I
10 think that was part of your report.

11 DR. SAM ARMIJO: That's not in their scope, yet, but, you know,
12 there are many other activities that the staff will take on, to come to a
13 recommendation. So, this was our idea, jus to -- when you get there, somewhere
14 along the line, you ought to re-look at the actions that would have to be put in
15 place, and see that there isn't a downside to those actions.

16 COMMISSIONER MAGWOOD: Yeah, I wanted to give you the
17 chance. You sort of did it in that context. I wanted to give you a chance to sort
18 of elaborate on the concerns the committee had about that aspect of it.

19 DR. SAM ARMIJO: Yeah, well, you know a heavy load drop on a
20 pool is not a minor event and there would be a lot of fuel being moved and
21 expedited. I don't know exactly what that means, but unless it was, you know,
22 one cask drop accident could really be more negative than just leaving the fuel
23 where it is, but we don't know that until we get the results of the scoping study.
24 But there are also issues that we're starting to review now, that we've just had a
25 review about the issue of long term dry storage and potential degradation of

1 cladding and casks, and things like that, that have to be looked at before you say
2 this is obviously the way to go.

3 COMMISSIONER MAGWOOD: Are there studies that -- is there
4 information that we have available, that give us a chance -- that will enable us to
5 quantify the risk associated with transfers, cask drops, things of that nature? Is
6 that something that's been quantified?

7 DR. SAM ARMIJO: To a certain extent. Some of the earlier
8 studies that the staff has referred to in their scoping study that they've got in their
9 background; they've addressed a number of the other hazards. So, they'll be
10 able to bring that information to bear.

11 COMMISSIONER MAGWOOD: Thank you very much. At this
12 moment, I'd like to move on to Dr. Shack. Just more of a general question about
13 the SOARCA work, I think it's already proven to be a valuable asset. When
14 Fukushima occurred, it was at our fingertips, and we were able to use it to
15 understand some of the things that were going on. How do you see SOARCA
16 being used by the agency, going forward? It's a tool in a toolkit. Where do we
17 use it? Where does it go from here, in your view?

18 DR. WILLIAM SHACK: I look at it as something that's used in
19 conjunction with the Level 3 PRAs, that we need to identify scenarios of interest,
20 and then I think, you know, that they may -- maybe to look at those in more detail
21 with SOARCA. You obviously can't use a SOARCA type analysis for every plant,
22 everything, but again, to look and focus on important scenarios. Again, I think it's
23 also, even if you're not using SOARCA analysis, to understand the uncertainties
24 associated with our best understanding of severe accidents, and the kind of
25 behavior that we do expect, just to have that insight as you're thinking about

1 these things is very important.

2 So, I think it's, as Mike mentioned, you know, we think that severe
3 accident training for the staff, sort of based on SOARCA type MELCOR analysis,
4 just to give people an understanding of kinds of things that can happen. You
5 may not have the exact scenario, but to have that kind of understanding provides
6 insight, even if you haven't analyzed the specific situation.

7 COMMISSIONER APOSTOLAKIS: So, and to some degree, you
8 see it as an opportunity to enhance the overall training of the staff.

9 DR. WILLIAM SHACK: And to provide insight and understanding of
10 severe accident behavior. I think, you know, we've looked at these two
11 scenarios. I think in conjunction with the Level 3 PRA, where we've made a
12 more systematic evaluation of the overall risk, then I think it becomes, perhaps, a
13 very important tool for refining those estimates, which again, because you're
14 looking at many, many scenarios, you typically treat in a more conservative and
15 bounding way, where we now have a tool to look at those in a more detailed way,
16 but again, I think the problem with SOARCA as a risk study is that you, you
17 know, you've got a very limited set of scenarios, and so you're not sure what the
18 context is. You know, we study these particular scenarios and we understand
19 them as best we can. They are our true best estimates, but you need to put that
20 into the bigger picture, to get a full risk estimate.

21 But again, the insights that you get into severe accident behavior, I
22 think are generalizable and you have to keep those in mind, as you're looking at
23 things, but as a quantitative measure, it's difficult to -- you know, I've never quite
24 understood what people mean by consequence study. You know, you do a study
25 for a particular reason, and, you know, depending on the kind of question, it

1 comes back to Commissioner Apostolakis' question on uncertainties. You know,
2 you treat the uncertainties depending on what you're looking for and the kind of
3 question you're trying to answer. You know, does the uncertainty impact your
4 decision is really the criteria, and we have a NUREG that essentially, I think,
5 treats uncertainties that way, and all the mathematical tools that we use to deal
6 with uncertainty, when you're all done, the way that you use that, is, you know,
7 has it impacted your decision making, and I think you may, you know, from the
8 Commission's point of view, that's the goal we're trying to reach with uncertainty
9 analysis.

10 COMMISSIONER MAGWOOD: All right. Well, thank you very
11 much. Time is more than up. I just wanted all of the committee members here,
12 thank you, again, for your contributions, and for the time and effort you put into
13 your work. Thank you. Thank you, Chairman

14 CHAIRMAN JACZKO: Commissioner Ostendorff?

15 COMMISSIONER OSTENDORFF: Thank you, Mr. Chairman. I
16 want to add my thanks to Commissioner Magwood and others, for all the work
17 you're doing. I know you've had a very, very full plate. I know, Sam, you said
18 that the work is, I think, manageable, but I realize that's a result of extraordinarily
19 hard work, and a commitment in rearranging a lot of schedules. I know that we,
20 the entire Commission, is very grateful for what you all do.

21 I want to turn to the spent fuel pool scoping study for a minute here
22 and ask a couple of questions. With respect to the hydrogen explosions of
23 Fukushima Dai-ichi, do you -- does the committee have some sense for the
24 technical forces associated with the hydrogen explosions, and how those forces
25 might relate to the force of the seismic event as they impact damage, or potential

1 damage, on the spent fuel pools?

2 DR. SAM ARMIJO: I don't, and we haven't reviewed that, and the
3 staff, if they've looked at it, we haven't discussed it with them.

4 COMMISSIONER OSTENDORFF: Is anybody aware -- does
5 anybody have any data on that topic?

6 DR. MICHAEL CORRADINI: If I might just ask you to clarify the
7 question --

8 COMMISSIONER OSTENDORFF: Yeah, I'll try. You know, there's
9 obviously huge explosions from hydrogen, so are you aware of any technical
10 body that has assessed the explosive force as a result hydrogen explosions and
11 how those forces might compare to the force associated with the seismic event
12 experienced in earthquakes?

13 DR. MICHAEL CORRADINI: I don't think anybody's done the
14 comparative calculation. I'm absolutely sure that based on, you know, the '80s,
15 research has a great compendium of experimental data that they can use to do
16 that sort of comparison. My quick estimate is small in comparison to seismic
17 events. It's a different frequency and load application. I guess that's the expert
18 over there, but I would say to the extent that one can characterize the two source
19 terms, I think staff could easily do that sort of comparison.

20 COMMISSIONER OSTENDORFF: Anybody else, any comments
21 on that?

22 DR. SAM ARMIJO: I have one in it depends where the explosion
23 occurs. As you know, in Unit 1 and 3, they were in the refueling floor areas, and
24 that was mild compared to what happened in Unit 4. It was underneath and the
25 building bowed out on the walls, and so the severity of that explosion would be

1 different. So a lot depends on where it is, and I'm sure the staff has tools that it
2 could get at it, but it wasn't mild.

3 COMMISSIONER OSTENDORFF: The reason I bring it up is kind
4 of associated with Commissioner Apostolakis' comments and his Q-and-A time
5 with you, and I respect the ACRS process, and so forth, and I understand you
6 went through a process to vote on these additional comments, and I respect the
7 outcome of that, but I'd hate to see us not capture the lessons learned from
8 Fukushima, from a real event, as opposed to the computer simulations, and I'll
9 just tell you that my experiences in foreign defense is a lot of testing on
10 torpedoes. I think I shot about 460 to 480 advance capability ADCAP torpedoes
11 over many years. Only one of those was an actual warhead shot.

12 So, I'm making the point that, you know, DOD will only have an
13 actual go boom kind of test on a very small percentage of the weapons tests that
14 are conducted. I've been out to White Sands Missile Range, with other tests with
15 the Air Force, and Department of the Navy, and I'll just tell you that I think I hate
16 to see an opportunity here to learn from the actual event, as opposed to
17 computer simulation of Fukushima, and the ACRS and our staff not really be able
18 to capture those lessons, because I think they are very limited destructive type
19 testing events that anybody or any organization will ever be able to learn from.
20 This is perhaps one of the very few. Please feel free to disagree or push back on
21 that.

22 DR. MICHAEL CORRADINI: No, I agree. You've only identified
23 one. I can give you six others immediately, and some of the other members can
24 probably jump in, but I would totally agree with -- and that's why I think the
25 international program, at least as I understand it, and staff is here, they can jump

1 in and correct if they want, but I think the international program NRC staff is
2 actively involved with DOE trying to do that, because as they deconstruct, they're
3 going to start looking for evidence of things that aren't what they had predicted.

4 I'm thinking of things --

5 COMMISSIONER OSTENDORFF: Are you talking as far as the
6 spent fuel pools at Fukushima?

7 MICHAEL CORRADINI: Not spent fuel pools --

8 COMMISSIONER OSTENDORFF: That's what I'm talking about
9 here. I want you to -- because I'm surprised on one level that, you know, the
10 additional comments, that seems like it was a great opportunity to learn from this,
11 and you don't need to comment for it. I just kind of share Commissioner
12 Apostolakis' concerns as --

13 DR. SAM ARMIJO: We're already learning some interesting things.
14 The Japanese have just been reporting they found on the walls of the spent fuel
15 pool, at Unit 4, tiny, tiny, little cracks and bulging on the walls. Do our models
16 predict that for the seismic event, or is that the result of the hydrogen explosion,
17 or some other thing? So, we can always learn from actual events, but they're
18 complicated and it takes time.

19 DR. WILLIAM SHACK: To make sense out of these things, you
20 know, that's why we argue for a proactive approach, that, you know, you have to
21 really put these things in context, that, you know, to have an incident is one thing.
22 To be able to understand and relate that incident to our model requires a depth of
23 understanding. You know, we have to have information to compliment that,
24 which I, you know, that's been our argument for the need for a proactive
25 approach to decide, you know, what information it is we're looking for, and then

1 to make sure that we work hard to get that information, and, you know, it may not
2 come. We're not in control of this situation, but I think our emphasis has always
3 been on a proactive approach to try to get the information we need, to make
4 sense out of this. This is a glorious experiment. You don't really want to repeat
5 it.

6 COMMISSIONER OSTENDORFF: No, I understand that, but that's
7 not my point is that I just, I think you will never have perfect information, you will
8 never have complete information and when you have an actual destructive event,
9 it's to our -- everybody's collective interest to learn as much as we can from the
10 actual event, as opposed to relying upon the absence of an actual event, just
11 computer simulations. Let me go on here. Again, on the spent fuel pool study, I
12 know that you all commented that the SOARCA project benefitted from peer
13 review, or you recommended a peer review be done for SOARCA, I believe --

14 DR. SAM ARMIJO: No, it was actually done.

15 COMMISSIONER OSTENDORFF: Yeah, but you thought highly of
16 the peer review approach taken. What do you see, your thoughts on the peer
17 review approach pros and cons, with respect to spent fuel pool scoping study?
18 Any ideas or opinions on that?

19 DR. SAM ARMIJO: Well, I'll tell you mine, we'd like to review it.
20 Whether or not it really needs a peer review, I'll leave that to my colleagues to
21 comment. I think it's -- personally, I think it isn't really necessary, but, Mike.

22 DR. MICHAEL CORRADINI: I'm still trying to understand -- I would
23 say, first we'd like to see some of the results before we comment on the need for
24 anything beyond.

25 COMMISSIONER OSTENDORFF: I'm talking more without -- I'm

1 saying from a process standpoint.

2 DR. SAM ARMIJO: Oh, routinely, kind of peer review these --

3 COMMISSIONER OSTENDORFF: Yeah, yea.

4 DR. SAM ARMIJO: I think a peer review is a very -- developing a
5 tool, a very important tool. A peer review could be very valuable. Application of
6 codes that we understand, then we're hooking them together to do a particular
7 analysis, I think we can handle that on our own, but it depends on the complexity.
8 Bill?

9 DR. WILLIAM SHACK: I guess I feel that in this particular case, I'm
10 not sure, and again, this is a personal opinion -- the ACRS has no position on
11 this. It certainly doesn't seem to be one where I would particularly see the need
12 for a peer review. I think, you know, we were looking -- the spent fuel scoping
13 study is part of a larger analysis anyway, that, you know, maybe you need to put
14 this together, but I think here we're applying tools that we understand reasonably
15 well.

16 COMMISSIONER OSTENDORFF: Okay, that's helpful. My time is
17 going to run out here. Did you have something that you wanted to add there, Dr.
18 Schultz?

19 DR. STEPHEN SCHULTZ: I just was going to say that we
20 understand what is being done, and I think the oversight review of the committee,
21 when the results are completed, will be sufficient.

22 COMMISSIONER OSTENDORFF: Okay. That's helpful. Thank
23 you. Let me do one last question here, Dr. Schultz -- and actually this is going to
24 be Dr. Shack. I'm sorry. On the SOARCA, on your Slide 41, there's a comment
25 about the fraction of the total risk captures not known, and I acknowledge that

1 this is a plant -- these are two plants, very plant specific kind of an analysis. So,
2 let's just say for the plants that were studied, do you see any fundamental flaws
3 in the approach that was taken? Again, I'm trying to figure out if better is the
4 enemy of good enough at times trying to figure out how to move forward. For the
5 two plants that were studied, were there any key concerns you have that impact
6 the assumptions or the uncertainties?

7 DR. WILLIAM SHACK: I think it's a very good analysis of these two
8 particular scenarios. The question is what out of the whole collection of
9 scenarios that are involved here, what fraction of the risk is represented, and
10 because we don't have a good overall PRA, we don't know. I mean --

11 COMMISSIONER OSTENDORFF: Well, do you have any opinions
12 as to what --

13 DR. WILLIAM SHACK: I can, you know, if I go back and I look at
14 the 1150 seismic PRAs, I can estimate, you know, that this is roughly half to two-
15 thirds of the risk, but again, those are PRAs that were done even for these two
16 plants, many years ago. There were scenarios that were important in those
17 PRAs that were not included in the SOARCA analysis. Again, based on the
18 expert judgment, without having a more complete review of that, it's just very
19 difficult to understand, you know, that the statement is clear. What fraction of the
20 risk is just not known? I think these are important and if I was going to pick two
21 scenarios to look at, or, you know, I think these are very good ones to look at.
22 Typically you would expect them to be important scenarios, but again, it's very
23 plant specific, and even for these two plants, because we don't have modern, up
24 to date PRAs, it's very hard to be more specific.

25 COMMISSIONER OSTENDORFF: Okay, thank you. Thank you,

1 Mr. Chairman.

2 CHAIRMAN JACZKO: Commissioner Svinicki.

3 COMMISSIONER SVINICKI: Gentlemen, good morning and thank
4 you for your presentations. My colleagues have already explored with you a
5 number of topics. I'll try to whittle my list down here. Dr. Armijo, on your slide
6 16, one of the items listed there amongst the multitude is review SMR regulatory
7 guidance. Has the committee engaged with the Office of New Reactors
8 regarding any kind of prioritization or specifically the activities there, and how
9 they're sequenced? Do you know the topics of the various guidance you'd be
10 looking at and the general time periods?

11 DR. SAM ARMIJO: We have a subcommittee that's dealing with
12 the SMRs and maybe if -- Dr. Bley here?

13 DR. DENNIS BLEY: Yeah, we're closely involved with them.
14 We've had a number of briefings already. We've written a letter or two on some
15 of the guidance. We're aware of the broad kind of guidance, and now they're
16 working on these design specific review plans, which are really the key to how
17 they're going to be looking at license applications for those. They are in
18 progress. We haven't seen those yet, but we're looking forward to seeing them,
19 but we have a continuing dialogue with them.

20 COMMISSIONER SVINICKI: And I was really asking from a
21 process standpoint in terms of there could be many different topics covered in
22 this guidance. So, the subcommittee or the full committee needs to be sure that
23 you all can plan for and have the relevant expertise available to look. So, I think
24 the topics are pretty diverse in the SMR area. So, the question was more are
25 you engaged in an ongoing basis with NRO, so that you can plan your work,

1 going forward. It sounds like you've indicated that you stay in communication
2 with them.

3 DR. DENNIS BLEY: That's true, and there will be some areas
4 where we'll need to bring on some of our consultants, I think, but at this point, we
5 haven't reached that level, and we've actually visited some of the test facilities
6 now, and are planning others. So, we are tracking it well, and see it coming.

7 COMMISSIONER SVINICKI: Okay, thank you very much. This is
8 also -- I'll direct this to Sam. If you want to have someone else respond, that's
9 fine. I was thinking about the long list of activities the committee is already
10 engaged in on Fukushima related work that the NRC has undertaken, and
11 looking forward, of course the NRC staff will receive really voluminous responses
12 to the requests for information that the agency has already issued of licensees,
13 and looking at natural hazards, the staff has a very high level description. We
14 will receive those responses to the Requests for Information, evaluate them in
15 some fashion, and then engage in regulatory decision making about if, and what,
16 regulatory responses or actions might be needed.

17 Conceptually, does the ACRS have some sense of how they would
18 be providing perspectives on that staff evaluation, or the staff's regulatory
19 recommendations going forward, or would it be typically in the form of if the staff
20 develops recommendations for the Commission, you would have an opportunity
21 to be briefed on those, and then provide feedback? Is that's the general concept
22 of how it would work?

23 DR. SAM ARMIJO: Yes, we would definitely want to be -- have the
24 opportunity to review. In some cases, the staff may present something to us and
25 we've responded, said that there really is no need for our review, but we'd surely

1 like to get a shot at everything, and knowing our members, I expect we would
2 review just about everything.

3 COMMISSIONER SVINICKI: Okay, thank you. Dr. Shack, on
4 SOARCA, one of your slides indicated more complete documentation of the
5 technical work is needed. I know you covered a lot of areas related to
6 uncertainties and other things, but is this statement related to that or is it that the
7 committee assesses that we are not documenting the work related to SOARCA
8 sufficiently?

9 DR. WILLIAM SHACK: Well, we haven't gotten an uncertainty
10 document for Surry and again, that seems to be something of a question of
11 whether that will be carried forward. We're essentially recommending that the
12 Surry uncertainty report be completed. There's a plan for a MACCS best
13 practices document, but again, that hasn't been completed, and so our
14 recommendation is that that document be completed.

15 COMMISSIONER SVINICKI: Dr. Corradini, you talked about -- I
16 believe I wrote this down as you stated it. You said, "We need to collect
17 essential data from Fukushima, to compare against what we are computing." In
18 your engagement with Commissioner Ostendorff just now, you were talking a
19 little bit about as the Japanese engage in remediation at the site, we may
20 actually, as the activities proceed, lose windows of opportunity to -- or windows
21 may close in terms of physical things that we would like to measure, determine,
22 or data that we would like to collect.

23 I know you reference the Department of Energy is looking at a
24 number of things. My understanding is that our Office of Research is in
25 collaborative discussions about our unique regulatory research needs, but in

1 terms of that engagement, do you feel that people are getting to the substantive
2 details that we might like to suggest be international research priorities? Are we
3 getting to the specifics on that in a timely way, and is it being done with
4 cognizance of the fact that the Japanese, of course, need to move forward on
5 remediating the site? If you were giving a very candid assessment, I know, I'm
6 certain meetings are being held and people are probably having discussions, but
7 in the interagency process, would you assess that we are getting to the specifics
8 of defining the research at a level of detail that it could be operationally acted
9 upon at the Fukushima site?

10 DR. MICHAEL CORRADINI: So, I -- you always ask hard
11 questions. I was just trying to decide where I'm going to start. I guess the quick
12 answer is that I think the staff is engaging with DOE and IAEA on this. There
13 were a number of meetings. I'm not familiar with all of them. In fact, Dr. Rempe
14 was at a couple that she might want to comment on, but my impression is the
15 Japanese in collaboration with IAEA are setting the tone as to the program.

16 Now, your second part of your question is, okay, now that they set
17 the tone, is this international juggernaut properly focused in on what's going on
18 relative to what the Japanese need to do to start on the outside, and work in to
19 clean up. My sense of it is yes, so far, okay, but they are going relatively slowly.
20 There's been a couple of documents that I've seen, that others may want to
21 comment on, where a number of the members have privately suggested things
22 that you ought to look at this, you ought to look at this, literally very specific
23 things. So, as you deconstruct the site and you start going in with visual
24 observation of the suppression pool, or visual observation of the drywell, do we
25 see previously molten material? What does it look like? Where is it? Do we see

1 cracking of the control rod drives or some sort of leakage through them?

2 So, there's been that level of specificity that has gone back from the
3 RES staff to DOE and these folks. How this all has fit together in an integrated
4 plan at this point, I have not seen that, but I know that's under active discussion.
5 Did I at least address most of --

6 COMMISSIONER SVINICKI: You did, and since you commented
7 on what I'll call the earnestness of my questioning, really, I'm asking, I think
8 arising from two experiences. One is having visited Argonne when you happen
9 to be present, engaging with some of your graduate students. So, I would say
10 that my questioning of you is probably at least akin to, if not more gentle, than
11 your questioning of the graduate students that I observed.

12 [laughter]

13 DR. MICHAEL CORRADINI: We treat them with kid gloves.

14 COMMISSIONER SVINICKI: Okay, but at that time, I was being --
15 also learning about the work going on at Argonne, the TMI, and the, you know,
16 with core melting phenomenon, things like that, and we had discussed, although
17 tragic, you know, this event is something that it would be more tragic if we failed
18 to learn what we could from it, so...

19 DR. MICHAEL CORRADINI: No, I think you're absolutely right. I
20 guess I just -- Dr. Rempe can just jump right up to that microphone, if she is
21 dying to. I do think though that, I think a lot of what she's been doing with some
22 of the other laboratory staff, informing the staff on some of the things they want to
23 do, has been ongoing. I think Joy presented the work in Vienna, so.

24 DR. JOY REMPE: Thank you --

25 COMMISSIONER SVINICKI: And this is a reminder to me that

1 when I refer to the ACRS, I now need to say gentleman and Dr. Rempe.

2 DR. JOY REMPE: It's okay. I just wanted to clarify that it's my
3 understanding that the Japanese have had some sort of document go to NEA,
4 not IAEA, to say that they are interested in pursuing a program similar to what
5 was done after TMI, to get examples from the vessels of the various reactors,
6 and the reactor building with the spent fuel pool, had the explosion.

7 I think that, you know, the U.S., I think wanted to participate, I hope
8 would want to participate in such an effort, but and I think there are a lot of
9 experts that could bring some knowledge to bear on such a thing, but to do this,
10 it's important to have a well developed plan. One of the things we've learned
11 from the TMI experience is we ran out of money perhaps at the end, when we
12 could have organized things better if we'd planned ahead better, and so I think
13 that it's important that we think ahead, and try and plan, and participate in the
14 planning effort, and have adequate funding to participate in that effort, and to
15 support the Japanese in their effort.

16 COMMISSIONER SVINICKI: Well, thank you, and that takes me I
17 said this was rooted in two experiences, the other was having visited the Zion
18 site, which is undergoing very active decommissioning now, and I was presented
19 with facts that there was certainly opportunity to maybe get coupons and
20 samples, and have, study some, you know, aging phenomenon materials, basic
21 materials phenomena there, but someone has to have the money to do it, and so
22 also there's the exigencies, of course, of a very active decommissioning. People
23 just want to rip and ship, and get on with it, you know. So, there is often the
24 research is -- opportunities are lost in that urgency just to move forward. So --

25 DR. MICHAEL CORRADINI: We happen to always pick the places

1 where I've been. That was my coop engineering experience at Zion, when it was
2 starting up. As Dr. Stetkar took over and was an operating engineer there, so, I
3 agreed that you would like to -- you would actually like to take advantage of the
4 hazard decommissioning, to try to understand things in terms of appropriate
5 sampling, and look at aging phenomena. The only thing I'd be careful about is
6 that's a plant that's been shut down for 20 years. So, you want to make sure you
7 deconstruct what was there or what was there when the plant was shut down
8 versus how it aged, and it's on a call, it kind of safe store --

9 COMMISSIONER SVINICKI: Yes, yes. Okay, fair enough. All
10 right, thank you, Mr. Chairman.

11 CHAIRMAN JACZKO: Well, I wanted to follow up, and I think these
12 have been good questions, certainly about Fukushima. To some extent, they're
13 probably better, in a way, questions for the staff, and assuming we can get some
14 follow-up on what exactly you all are doing in terms of post-cleanup, recovery,
15 and post-accident cleanup stuff... Jennifer, do you want to --

16 JENNIFER UHLE: Everything that's been said has been accurate,
17 certainly right now, there is -- Brian is over -- Brian Sheron, office director, is
18 overseas at CSNI, and one thing that is going to be discussed is what are the
19 next steps for Fukushima. There is some dialogue about whether IAEA is the
20 right place to do some of the deconstruction work, or the salvaging work, or
21 CSNI.

22 I know right now that the Japanese are asking for help in that area,
23 and we're certainly working with DOE to provide some of our advice. Now, the
24 next step here is we're going in a couple of weeks, to a meeting on the analyses
25 that all the different countries have done, and part of that will be comparing

1 analysis, and also coming up with what are some of the parameters most
2 important to look at, so that it's a start in that direction, although they'll have other
3 lists -- other lists have been put together. So we've had a recent conversation
4 with IAEA and it's likely that it will be IAEA that would take that role to, you know,
5 get the salvaging aspect for the samples needed.

6 CHAIRMAN JACZKO: Turning back to SOARCA, this thing has
7 been in the works for a long time, and I think it's been a very good product, but I
8 found it interesting actually, I think, I don't know, Dr. Shack, if you made the
9 comment, or whoever made the comment about kind of knowing -- having a --
10 well, it was in the context of uncertainties, knowing what the product is for, and I
11 just found one of the more interesting comments I think in your letter, was that
12 the comparisons with earlier studies such as the NUREG/CR 2239, which I think
13 that is the Sandia Siting Study, which were intended to represent the risk from all
14 scenarios should not be made without acknowledging these differences. If you
15 were to have asked me, I don't know, whenever we started this, four years ago,
16 why we were doing SOARCA, I would have said, "It is to be able to compare with
17 the Sandia Siting Study."

18 So, we went through and wound up, for a lot of practical reasons,
19 getting a report that is telling us things that isn't really -- didn't really do probably
20 what we intended, which was quite frankly, I guess was Pete Lyon's idea was
21 essentially to have something we could use, instead of the Sandia Siting Study,
22 because that is -- appears to be an outdated study with --

23 DR. WILLIAM SHACK: Yeah, but you have to ask yourself what
24 the purpose of the Sandia Sighting Study is.

25 CHAIRMAN JACZKO: Well, that's part of the problem too then,

1 and of course, that was a different -- the purpose of that was a sighting study. I
2 mean it was not necessarily a reactor risk assessment in the same way, so --

3 DR. WILLIAM SHACK: Right, and so I think, you know, asking it to
4 be a risk study --

5 CHAIRMAN JACZKO: Yeah.

6 DR. WILLIAM SHACK: -- is the wrong question.

7 CHAIRMAN JACZKO: Yeah. Well regardless, I think --

8 DR. WILLIAM SHACK: As much as it's been misapplied as a risk
9 study.

10 CHAIRMAN JACZKO: Yeah, yeah. It, you know, going forward, I
11 think, you know, particularly where there seems to be morphing is in the Level 3
12 PRA, and really that that being the thing that we could really use. I think it's
13 important that we make sure we define that, and do it in a way, and try and work
14 through the completion of that activity in a reasonable timeframe, so that we --
15 when we start with a goal, we wind up being able to say, "I think we've got the
16 same goal in mind," but the -- turning to -- Dr. Shultz, maybe you could answer
17 this, or anybody. You noted in the one letter the issue of the 1 percent for the
18 licensed thermal power for the venting capability, and I guess, as I understand,
19 that's decayed after a few hours. So one of the comments in your letter was that
20 we should look at the 1 percent and better justify it.

21 Did you all have specific scenarios in mind in which you believe that
22 1 percent was not sufficient, that we should accommodate more than 1 percent
23 decay heat, or was it simply you needed documentation to understand the --
24 were there scenarios in which you consider venting would need to occur more
25 quickly than those few hours, in which you'd get down to about 1 percent?

1 DR. STEPHEN SCHULTZ: We were really looking for additional
2 justification to the 1 percent.

3 CHAIRMAN JACZKO: Okay.

4 DR. STEPHEN SCHULTZ: We recognized that the 1 percent does
5 match up with decay heat after a few hours, but then --

6 CHAIRMAN JACZKO: So if that were the reason for the 1 percent
7 because it matched up to decay heat after a few hours, would you find that
8 sufficient justification or are you really arguing about the hours?

9 DR. STEPHEN SCHULTZ: No, we're not looking specifically, but
10 there -- we would like at least a qualitative justification of why that was selected.

11 CHAIRMAN JACZKO: Okay.

12 DR. STEPHEN SCHULTZ: There are other scenarios that would
13 suggest that venting might need to be happening earlier, and therefore at a
14 higher --

15 CHAIRMAN JACZKO: Okay.

16 DR. STEPHEN SCHULTZ: -- decay heat level.

17 CHAIRMAN JACZKO: Did you communicate the -- have you
18 communicated those scenarios to the staff?

19 DR. STEPHEN SCHULTZ: I think they're aware of the scenarios.
20 Again, it comes back to the justification of why the particular value was selected.

21 CHAIRMAN JACZKO: Okay. Anybody --

22 DR. STEPHEN SCHULTZ: And it gets some of the -- what we've
23 discussed here in terms of looking at sensitivity, and that would then help to
24 support the decision of 1 percent.

25 CHAIRMAN JACZKO: So again, I guess -- I guess I'm a little bit

1 still not clear. So do you support the 1 percent or not?

2 DR. STEPHEN SCHULTZ: We think it's a good choice, but the
3 staff didn't provide justification for it.

4 CHAIRMAN JACZKO: Okay, but you kind of -- I mean...

5 DR. STEPHEN SCHULTZ: It may be okay, but --

6 [talking simultaneously]

7 CHAIRMAN JACZKO: -- justification out there, right?

8 DR. STEPHEN SCHULTZ: No, no.

9 CHAIRMAN JACZKO: Right, I mean, what's the justification you're
10 looking for that you didn't -- I mean, if the staff says it's decayed after a few hours
11 and we believe after a few hours that's the early time at which we would need
12 venting. Would you agree with in that case then? I guess I'm hearing in a way
13 you wouldn't. You think that there are some scenarios that could require venting
14 earlier than a few hours.

15 DR. STEPHEN SCHULTZ: It's more in terms of looking at a
16 spectrum of scenarios in order to make the judgment that picking a single value
17 or this value as the appropriate choice to provide the guidance for design and
18 implementation is appropriate, and there was just no information associated with
19 the provided -- with the order.

20 CHAIRMAN JACZKO: So if I told you that it's a couple of hours
21 would you agree with that?

22 DR. STEPHEN SCHULTZ: We know it's a couple of hours.

23 CHAIRMAN JACZKO: So you do you agree --

24 DR. STEPHEN SCHULTZ: We're looking for additional
25 justification.

1 CHAIRMAN JACZKO: Okay, so you don't agree with just a couple
2 of hours, I guess -- I'm trying to understand what this means if you --

3 DR. MICHAEL CORRADINI: If I might -- if I might just jump in just -
4 - I don't think we went far enough to kind of answer your question, so we're -- as
5 usual we're going to say that at this point I don't think we have a committee
6 decision on this, but I would say that to the extent that we want to see what the
7 justification is, at least from my standpoint, I'm searching through -- as you're
8 asking all these questions, I'm searching through all the potential scenarios that
9 would get me in trouble before a couple of hours, and I can't think of any, but I'd
10 like the staff to at least sit down with us and talk us through it.

11 CHAIRMAN JACZKO: And so basically you're looking for them to
12 come back and say there aren't any scenarios for a couple of hours -- okay.
13 Turning to the research report, which I think is always a very helpful report for us.
14 One of the things that -- as I was looking through, I noticed in there was
15 continuing highlighting of challenges in where we are with digital I&C and
16 Commissioner Apostolakis asked a few questions on this area, but one of those
17 issues that I think has come up quite a bit in the past is really how we deal with
18 cybersecurity and then the design review and the licensing process. And I don't -
19 -

20 DR. MICHAEL CORRADINI: Ask Charlie

21 CHAIRMAN JACZKO: Oh, go ahead then, and I didn't really get to
22 my question but I feel like you kind of know where I'm going, so --

23 DR. SAM ARMIJO: We know the answer.

24 DR. MICHAEL CORRADINI: It's almost like a game show --

25 CHAIRMAN JACZKO: Right, exactly. It's like somebody get --

1 pushes the buzzer before I get to the actual question. Why don't you answer it
2 and we'll see if it's the right question.

3 CHARLES BROWN: Be more crisp on this one than I was with the
4 Commissioner Apostolakis. There's two aspects to this, there's cyber security
5 planning, and then there's the architecture of the system we have in place -- the
6 reactor protection and safeguard systems, and the control systems, technical
7 support center, and the main control room and EOS, emergency operating
8 center. How are those protected architecturally? 73.54, 73.50 I think the rule
9 says you have to have a plan. You have to generate the plan, but you don't have
10 to just tell us what that is right now when you're going through the design
11 certification.

12 However, right now, we're looking at the protection system and
13 safeguard systems very explicitly, and their architectures, and how they
14 communicate with both off-site corporate offices as well as the on-site other
15 facilities that may be used in various situations. If you look at the transmission of
16 data, and/or the movement of control signals from the equipments to the main
17 control room and these other facilities, they go along these large buses. Now,
18 with all the information as well as control signals, they're buried in there in some
19 circumstances.

20 Then, off to the side, there's a little box that's called a firewall, and
21 that's goes off to the corporate offices. And you look at that and say, well, what
22 is that? What does it consist of? Well, it's whatever they want to do. And the
23 answer that we've been struggling with trying to get the staff to tell us or define
24 that in a manner that that cannot be compromised from external sources. If it's
25 anything we've learned over the last few years, there are some very, very smart

1 individuals out there that can attack a firewall that is configurable remotely.

2 So why isn't the staff being more aggressive at forcing a design
3 decision during the DCD stage, during the design certification stage, so you know
4 what the architecture that you provide will support what you desire to achieve in -
5 - through the rules, 73.54. And so there've been -- it has not -- it's not just in the
6 research report, there have been a number of comments in the letters we've
7 made.

8 CHAIRMAN JACZKO: I noticed there's consistency.

9 CHARLES BROWN: Yeah. [laughs]

10 CHAIRMAN JACZKO: That's always a good bet.

11 CHARLES BROWN: So that's the thrust, trying to get a better
12 definition of -- like we've done on the performance of the protection systems and
13 safeguard systems in terms of having the voting units lock up relative to
14 corrupted data. We've been able to come through that through the use of the
15 watchdog timers, and things which monitor those, such that if you had one
16 channel corrupting all of them -- excuse me -- really excuse me -- that you would
17 be able to come through that okay. The cybersecurity aspects we have gotten
18 no answers yet.

19 DR. MICHAEL CORRADINI: I will say, I wanted Charlie to start this
20 off because if I dared try to do this I'd do it wrong, but I do think that staff is aware
21 of this not only from a research standpoint, but also in terms of dealing with the
22 issue, and we're in communication with staff.

23 CHAIRMAN JACZKO: Okay.

24 DR. MICHAEL CORRADINI: Is that fair?

25 CHARLES BROWN: That's also true, we've had --

1 CHAIRMAN JACZKO: Think we have a successful resolution path
2 at this point? Or we're aware that there's a --

3 CHARLES BROWN: No.

4 CHAIRMAN JACZKO: -- the bridge is out.

5 CHARLES BROWN: The simple answer is from my background
6 and training is no. We don't have a successful answer yet.

7 CHAIRMAN JACZKO: Okay, okay, well thanks. Well I appreciate
8 that, and you know, obviously this is a --

9 CHARLES BROWN: That's -- by the way, that's my opinion, I don't
10 think we've written that down that there's -- in a letter. I'm trying to remember
11 back to some of the letters. There -- I guess I've got committee -- my peers have
12 supported our thought processes on this, so...

13 CHAIRMAN JACZKO: And as I said, this is a complicated issue,
14 but I think it's important to continue to raise it because it does have significant
15 implications if we get it wrong, and I know the staff has a view on why they think
16 their approach is acceptable, but I think it's worth continuing the discussion and
17 hopefully we will get to a point where you all can be in alignment on this. I think
18 that would be good for everybody.

19 CHARLES BROWN: May I make one other observation? We are
20 trying to be very judicious because we have no disagreement with the idea of a
21 cyber security plan being submitted sometime farther down the line. There's not
22 a problem with that. The problem is you don't want to deliver an entire system
23 which is not compatible with maintaining that type of security we want -- and not
24 having people come in and be able to fake out the operators in the main control
25 room when the plant's doing one thing, they're seeing something else.

1 CHAIRMAN JACZKO: Good. Well, as I said, I appreciate your
2 insights on this, and we'll continue to have the dialogue, and I encourage you to
3 continue to have that with the staff, and I know the staff will continue to share
4 their thoughts with you.

5 Again, I want to thank everybody for your presentations and for the
6 work that you have. You know, we didn't touch on the -- some of the non-reactor
7 things, but I know Mike is back there, and you know, I encourage you to continue
8 to focus on those issues as well. We have a lot of interesting things in areas like
9 WIR that, I think, would benefit from the committee's involvement, and I hope
10 you'll consider taking a look at some of those things, as well as some of the other
11 thing you're doing. Thank you.

12 [Whereupon, the proceedings were concluded]