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UNITED STATES NUCLEAR REGULATORY COMMISSION
MEETING WITH THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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FRIDAY

November 7th, 2008

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The Commission convened at 2:00 p.m., the Honorable Dale E. Klein, Chairman
presiding.

NUCLEAR REGULATORY COMMISSION

DALE E. KLEIN, CHAIRMAN

GREGORY B. JACZKO, COMMISSIONER

PETER B. LYONS, COMMISSIONER

KRISTINE L. SVINICKI, COMMISSIONER

1 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS:

2 DR. WILLIAM SHACK, Chairman

3 DR. SANJOY BANERJEE, Member

4 DR. MARIO BONACA, Vice Chairman

5 DR. SAID ABDEL-KHALIK, Member

6 DR. MICHAEL RYAN, Member

7 DR. GEORGE APOSTOLAKIS, Member

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CHAIRMAN KLEIN: Good afternoon. We're definitely looking forward to the presentation today. Before I begin, congratulations Mike. It's good to have you at the table.

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DR. RYAN: Thank you, Mr. Chairman. Appreciate it.

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CHAIRMAN KLEIN: I understand that we have two more members, Harold Ray and Charlie Brown that are also – you're hiding over on that side.

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And we also have a new Staff Director, Ed Hackett. So, a lot of change has occurred recently with the ACRS.

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Today we're going to hear about some important issues: the PWR sump issue, the BWR extended power uprate. We'll also hear about the TRACE thermal hydraulic code.

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While I've been acknowledging people I should certainly acknowledge that this may be Bill's last time sitting at the table as Chairman; maybe not the last time sitting at the table. We certainly appreciate your service both on the ACRS and in your role as Chairman. So, thank you for those activities.

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We may have -- depending on how long the questions are today, Commissioner Lyons has a flight to catch. So, in the event that Commissioner Lyons gets up and leaves it's not because of lack of interest.

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21

So, any comments from my fellow Commissioners? Bill, would you like to begin?

22

DR. SHACK: Yes, I'd just like to start with an overview of some of

1 our accomplishments since our last meeting with the Commission on June the
2 fifth.

3 We've issued nine reports. The topics include security and aircraft impact
4 rulemaking. And again, we think these rules represent an important
5 accomplishment in improving the security of nuclear power plants. We've
6 continued our work on reviewing selected chapters of the ESBWR design
7 certification.

8 We issued, I think, an important report on the TRACE thermal hydraulic
9 system analysis code, which has been a long-term project of the Commission.
10 And sort of reporting on the progress that we have on the peer review of TRACE
11 and its use in the regulatory process. Professor Abdel-Khalik will be discussing
12 that today in more detail.

13 We also issued a report on progress in the PWR sump performance issues
14 and our views on the remaining issues. Dr. Banerjee will be discussing that in
15 more detail today.

16 Again, new plant activities have been continuing. As we noted we're
17 supporting the design specific approach with design specific subcommittees. The
18 one that's fully ongoing is the ESBWR that we're continuing the chapter by chapter
19 review of that and we've provided four interim letters on 18 chapters and we're sort
20 of reaching the end of the interim review and pulling it together.

21 We've also been reviewing topical reports associated with the US-APWR
22 design. Again, every licensee seems to have a slightly different strategy for

1 design certification. And again, the chapter by chapter approach with the ESBWR,
2 sort of this heavily topical report kind of flavor with the US-APWR.

3 Our EPR subcommittee participated in the Quadripartite working group
4 meeting on the EPR design in Europe. And we're continuing to interact with NRO
5 staff to establish schedules. Just looking down the road there's a lot of work to be
6 accomplished and it's important that we all understand our roles.

7 Again, other ongoing and future activities include the advanced reactor
8 research plan. We expect our activities -- our efforts on licensing activities will
9 continue to increase in 2009. We'll have combined licenses for our combined
10 operating license applications for new reactors. The work on design certifications
11 will continue.

12 Again, Digital Instrumentation and Control systems is important both in the
13 design certification where we're looking at plants and in a deeper understanding of
14 Digital Instrumentation and Control systems and their impact on nuclear safety.

15 We also have, again, extended power uprates for existing reactors, an
16 important one. Next slide, please.

17 Again, a number of technical topics: fire protection, high fuel burn up and
18 cladding issues, again, especially as we're pushing fuel to higher duty in extended
19 power operates. Human reliability analysis. We are sort of reaching the end of
20 the resolution, hopefully, of the sump strainer issue. Next slide.

21 We've just begun to or we had a preliminary review of the PTS rule and
22 we'll be looking forward to that as an important risk informed rule in the next year.

1 Our senior technical adviser, Hossein Nourbakhsh, has prepared a white
2 paper that provides a historical review of the development of our understanding of
3 the consequences of severe accidents and explores the feasibility of using a
4 simplified approach to updating results from previous study to permit comparison
5 of some aspects of SOARCA. And again, that's part of our effort to respond to the
6 SRM to continue working with the staff on moving SOARCA forward.

7 There's a number of challenges for us in calendar year 2009. We, again,
8 have a very full plate of licensing activities where essentially our Congressionally
9 mandated efforts on seven license renewal applications, we'll have design
10 certifications, an amendment for the AP1000, the ESBWR and we'll be continuing
11 work on the EPR and US-APWR.

12 We also have an interim review of four combined operating license
13 applications and reviews of three extended power uprates.

14 We also have to maintain cognizance of some of the activities that were
15 formerly the realm of the ACNW in the areas of health physics, decommissioning,
16 fuel cycle and low-level waste.

17 We're estimating that we'll need at least 50 days of subcommittee meetings
18 for essentially our mandated licensing regulatory efforts and any emerging issues
19 would require additional meetings.

20 One of the things that's going to happen is that we're probably going to
21 have to conduct some of our meetings in parallel to meet schedule, which will
22 affect the ability of members to fully participate in all reviews of interest to them

1 and will represent a difference in the way that we've been working at least for the
2 past decade.

3 We also think it's important for us -- and again, it's a challenge to maintain
4 the broad expertise and experience and diversity that we have in committee
5 membership.

6 Our members are now from universities, licensees, vendors, national labs,
7 Naval reactors and independent consultants.

8 We have increased our expertise in digital control systems and broadened
9 our understanding of international experience with nuclear power systems and I
10 think we have a very good and a very effective committee, but it will be a
11 challenge to maintain that kind of quality membership.

12 That completes my overview. Our next speaker is Dr. Banerjee who will be
13 discussing the sump performance problem.

14 DR. BANERJEE: Thank you, Bill. I'm really going to talk about
15 GSI-191, which is the assessment of debris accumulation on PWR sump
16 performance. So, without further ado let me give you a little background.

17 There were several incidents in the '90s, amongst them Barseback, in
18 which a safety relief valve opened and the steam jet impinged on some insulation.
19 About 500 pounds of insulation were then carried into the wet well where two of
20 the five strainers were significantly plugged, so that ultimately one of the pumps
21 started to cavitate. This was not such a major incident actually. It was just an SR
22 -- inadvertently.

1 They had to back flush the strainers after about an hour. There were some
2 similar incidents that occurred which ultimately led to the staff opening this
3 GSI-191 in the late '90s.

4 Eventually, this was followed after a parametric study of these screen
5 blockage effects for PWRs, Barseback and Limerick and Perry were BWRs.
6 There was a study done which indicated that we should also take a look at the
7 PWRs. This led to GL 2004-02, which really had two main points.

8 The first of these was that the potential for blockage for PWRs should be
9 looked at, evaluated. Second, that if there were measures that had to be taken to
10 modify the various systems and take corrective actions these should be
11 implemented.

12 So, we are really talking about still trying to resolve these issues, these two
13 main issues which were there in GL 2004-02. Now, I'm going to show you a rather
14 busy slide there for which I must apologize. I didn't have time to fix it.

15 In any case, what you see on the left-hand panel there is that red thing is an
16 expanding two-phase jet, which follows some sort of loss of coolant accident. It
17 impinges on insulation, a lot of which is around the steam generators and things
18 like that. The yellow bits flying around the insulation, with artistic license, and then
19 it falls to the bottom of the sump. And you see on the left-hand side it's falling
20 around what is the sump screen following which there's a little pump.

21 In any case, the right hand panel then shows you the water spraying down
22 or coming out of the break and forming a pool in the sump in which this insulation

1 is entrained.

2 As the long-term recirculation stops, of course there's the potential on the
3 left-hand side of that right panel towards the bottom, there's a screen which could
4 get clogged up with this debris.

5 Now, the second screen, if you like, in series is the core itself. So, if any
6 debris passes through that first screen, it's carried through the pump and goes
7 down stream then it has also the potential to get into the core.

8 The next slide really shows you the results of some experiments. What you
9 see there is a channel, really, in an experiment where the sort of debris that might
10 get carried through the screens is allowed to come in to the core and you see the
11 screen at the bottom is really the core inlet. Those white rods sticking out are sort
12 of guide tubes, supposed to be. You see the debris is fairly uniformly distributed.

13 So, if you look at the next screen -- please interrupt if you need to -- but you
14 can see it gets fairly uniformly distributed.

15 Be that as it may, let me now -- I'll get back to that later -- report on what
16 progress we've made with GSI-191.

17 First, I think all licensees have installed significantly larger screens. We've
18 actually gone and looked at some of these, the ACRS members, and they would
19 significantly reduce the pressure losses and to a significant extent also take care
20 of the first problem.

21 Some licensees have changed out insulation to reduce fibrous insulation,
22 which is really the bad actor because it tends to form mats, which give you

1 high-pressure losses. They've changed chemical buffers in some cases, which
2 could lead to effects which make a sort of goey mess that tends to increase
3 pressure losses as well. Water management strategies.

4 So, a lot of activity has been going on. They've also conducted these
5 screen head loss tests. I'll come to that in a moment.

6 First of all, most of these plants have different geometries, layout, chemical
7 characteristics, screen designs. So, each plant is sort of unique in a way. This
8 requires that the test be plant specific. It can't be done in a generic basis. That
9 really adds to the complexity of the problem.

10 I'd say that the staff have been very diligent in interacting with the ACRS.
11 We've had many subcommittee meetings and they've developed protocols and
12 reviews interacting with us on how some of these tests should be conducted so
13 that they're prototypical.

14 Really, at the bottom of the slide what we show is that the main issue that
15 concerns us and the staff is how do you extrapolate from these relatively small
16 scale tests to plant scale? That's really the central issue.

17 If we look at the next slide now, our views are tests in which most of the
18 debris is entrained, especially the fine scale debris, which then impinge on these
19 stump screens. These tests are probably relatively easy to extrapolate. We feel
20 comfortable with the sort of results coming out of there. And I think the staff does,
21 too.

22 I think that also with regard to chemical effects they have developed

1 protocols which are adequate. So, both these things are well taken care of in the
2 test.

3 We still - and I think the staff also - still have concerns about tests in which
4 a significant part of the debris is allowed to settle out upstream of the screens.

5 Here it's a little more difficult, then, to say whether these tests are
6 prototypical or not because the flow conditions and all these things start to matter
7 as to how much will settle out, how much won't settle out and these sort of issues
8 arise.

9 Anyway, progress is being made in this direction as well.

10 Let me now move on to the next slide which has to do with the downstream
11 effects. So, the impression I want to leave you with is that with regard to the first
12 screen, which is the main strainers, I think we've made a lot of progress. The
13 issue really is how to deal with these cases where things settle out.

14 With regard to the downstream effects, the core is sort of a second screen,
15 if you like. While the ex-vessel downstream effects, I think, have been well taken
16 care of we're still investigating what happens to the vessel itself and the PWR
17 Owners Group is conducting a series of tests.

18 We've been interacting with the staff on this and we are trying to ensure,
19 together with the staff that the range of conditions covered are wide enough and
20 that they include the cold-leg breaks, hot-leg breaks, and all sorts of things that
21 can happen there.

22 This is a very complicated issue because we also have to get the fiber

1 length characteristics to be representative of what might happen in a real accident,
2 what might pass through the first set of screens.

3 In addition to these experiments there have been analysis that the staff
4 have been doing using TRACE to look at what sort of levels of blockage can we
5 tolerate so that we can come up with a success spot. One minute. Next slide,
6 please.

7 The closure process is detailed there. Each licensee submits a way to
8 resolve this generic issue, called the GL. There's a detailed staff review with RAIs,
9 but what I wanted to point out there is there's an Integration Review Team.
10 Because each of these are so different, the Integration Review Team tries to
11 ensure consistency between each of these of submittals. I think that process is
12 working fairly well.

13 Let me close with the last slide there. We think that the staff has proposed
14 a systematic process for closure of GSI-191. Of course, these have to be plant
15 specific, but the Integration Review Team takes care of some of these problems.

16 We see there are certain problems still left, but we endorse the proposed
17 closure process and appreciate the efforts the staff has made in this direction.

18 Thank you.

19 DR. SHACK: Our next presentation will be by Dr. Bonaca on our
20 views on the Power Uprates for BWRs.

21 DR. BONACA: Good afternoon. The impact of EPU on a power
22 plant in a BWR is highly plant specific, necessitating focused reviews on

1 decreases in margin to regulatory limits. For example, ATWS peak pressure, peak
2 clad temperature; impacts on equipment and components performance, for
3 example, issue of steam dryer integrity.

4 Changes in core and fuel performance, for example, the fraction of fuel that
5 will operate near thermal limits. And impact on systems relied upon to perform
6 safety functions, for example, containment overpressure credit to ensure adequate
7 NPSH. Next page.

8 Currently, the ACRS focuses on two technical issues. One is steam dryer
9 integrity and the other one is containment overpressure credit.

10 Steam dryer integrity remains a challenging issue because the impact of the
11 acoustic loads on the dryers depends on plant specific dryer design and those on
12 steam line configuration; therefore, resolutions are very plant specific.

13 The resolutions we have noted today are first, replacement of dryers and
14 instrumentation of the dryers to monitor performance. We have seen the use of
15 the new and evolving analytical methods to predict loads.

16 We have also been informed that there is installation of branch lines to
17 dampen vibrations. We have not seen these applications, but we understand that
18 that's what some licensees attempt to do.

19 And finally, we consistency see reliance on deliberate power ascension
20 testing to monitor performance as we go up to power. Next.

21 To date, only Quad Cities Unit 2 and Susquehanna Unit 1 steam dryers
22 were instrumented. Other licensees measure steam line to strain data and

1 depend on analytical acoustic-circuit model to infer steam dryer pressure loads.

2 We note that modeling and predictions have improved, but today,
3 acoustic-circuit model was benchmarked only against Quad Cities Unit
4 2 measured pressures. Hopefully, additional data from Susquehanna can be used
5 for doing additional benchmarking.

6 Today, however, it is only Quad City Unit 2. This is a limited validation for a
7 model which addresses such a complex set of conditions. Next.

8 We accepted the Hope Creek EPU application steam dryer evaluations in
9 part because of predicted large margin to the stress limit, a factor of two. We note
10 that without further validation, we will continue to expect large margin to the stress
11 limit in future applications. Next slide.

12 Next slide I'll speak about containment overpressure credit. At EPU
13 conditions, available NPSH for safety systems is reduced. For some plants,
14 demonstrating adequate NPSH for EPU operation requires: first, additional
15 containment overpressure credit.

16 Now, I want to note here that credit and containment of overpressure in
17 general degrades defense in depth by making a CCS performance dependent on
18 containment performance. It essentially ties together the performance of the
19 cladding in a LOCA versus the availability of containment isolation.

20 It reduces margin to cavitation. And also it is contrary to the guidance
21 provided by Reg Guide 1.1, which is an old Reg Guide, but is still valid. It has
22 some of the thoughts that the ACRS has been presenting embedded in the Reg

1 Guide.

2 In some cases, operator action is needed to terminate drywell cooling to
3 increase containment pressure so the containment available pressure becomes
4 higher than required pressure.

5 Now, that's a concern to us especially for those of us who have experience
6 with operations because here we have a direction to an operator to perform an
7 action, which is counter to all the instructions he receives regarding the equipment
8 and how it should be aligned to bring down pressure in containment to prevent
9 releases. So, it is an issue that is complex. Next page.

10 In some cases pump cavitation is expected even with overpressure credit.
11 Now, when we have that we have to rely hopefully on the conservatism in the
12 analysis to hope that in real life and in more realistic conditions there will be no
13 cavitation.

14 But really, there isn't -- determination oftentimes is being made without the
15 benefit of a best estimate calculation to make the judgment. So therefore we have
16 to conclude the cavitation is expected even with overpressure credit. Next.

17 The ACRS position is that we clearly were not supportive of granting credit
18 for back pressure, but then we, I guess, changed our mind in 1997. We stated
19 that COP credit is acceptable if it is justified by the approach in Reg Guide 1.174,
20 which means the risk-informed approach with considerations of other issues, such
21 as defense in depth and the margin so that the issues that I raised before would
22 be considered in the determination.

1 In 2005 we expanded the recommendation to consider if deterministic
2 analysis could be used to support credit. We said that COP credit is acceptable if
3 there is no practical alternative and if deterministic analysis show required
4 overpressure is small and duration limited to a few hours.

5 Here we're trying to define a limit and we understand that that's a pretty
6 rough estimation here. We're talking about a little credit for a short time. But in a
7 way we were talking about, again, maintaining margin or having an understanding
8 of how much margin we have available to cavitation and also to minimize the
9 dependency on the containment isolation, which is not going to be probably
10 constant. The probability of losing containment isolation is likely to increase with
11 time given the conditions in containment. Next.

12 The staff position is different because they view no limits on amount of
13 overpressure and duration are needed as long as available overpressure is
14 supported by conservative calculations.

15 Again, they rely more on the design basis or the estimation of the
16 evaluation of special events to make a call, but an evaluation of margin is not
17 provided. Next.

18 The ACRS and the staff disagree on the issue of margin and duration and
19 magnitude of acceptable overpressure. This agreement was recognized in 1997
20 and then again in 2005. The staff proposed Revision 4 to Reg Guide 1.82 at that
21 time, "Water Sources for Long-Term Recirculation Cooling Following a LOCA" as
22 a means of addressing the ACRS concerns.

1 In fact, a risk-informed approach was being considered for inclusion in the
2 Revision 4 to Reg Guide 1.82, but the proposed revision was not issued and has
3 not been issued or developed. Next.

4 Here, as I did in June, I provided the Browns Ferry overpressure credit
5 issue as an example of the difficulties that we have in reaching the same
6 conclusion between us and the staff.

7 For Browns Ferry Units 1, 2 and 3 they need credit for back pressure for all
8 the events, LOCAs and special events. The limiting event, however, is the
9 Appendix R scenario where containment overpressure credit of up to 9.3 psi is
10 needed for 69 hours. Now, that's a lot of credit for a long time, in our judgment.
11 That's three days.

12 In that particular analysis drywell cooling is in fact terminated to maximize
13 available overpressure. The margin between available and required overpressure
14 is as low as 1.6 psi. Most of all, if in fact, the drywell cooling is not terminated you
15 have a situation where for a number of hours the required overpressure exceeds
16 the available overpressure. And that's not good. So, there is a clear dependency
17 on operator action. Next.

18 In February 2007 in our Browns Ferry Unit 1 report on 5% power upgrade.
19 We pointed out that because of this consideration granting credit at 120% power
20 uprate would require more complete evaluations. Next page.

21 This lists some of the viable solutions that we proposed. Clearly, in the
22 Appendix R scenario there is an alternative and we said that could be a physical

1 change by which a second RHR train is protected. Now, we mentioned it because
2 some licensees before have opted for that solution.

3 For the best estimate for the LOCA scenario we said provide us with a
4 realistic calculation so that we can make a judgment on whether there is enough
5 margin and the time that you have need for credit. In the belief that in fact if you
6 remove some of the excess conservatives for LOCA you can make sure in fact
7 that you have sufficient margin even from our criteria.

8 And finally, we also proposed the use of more rigorous risk assessment for
9 fire scenarios to demonstrate low risk. We felt that that could be done. Next.

10 TVA has recently provided additional information to support their request for
11 overpressure credit. We will consider this new information during our formal
12 review of the Browns Ferry EPU final safety evaluation. And hopefully, we find a
13 closure to this issue. That's going to be specific to TVA and Browns Ferry.

14 The difference in staff and the ACRS position still need to be resolved
15 because otherwise we will encounter the same difficulty as we do our
16 determination for future applications. Next.

17 In conclusion, I would like to summarize it by saying that to understand the
18 safety impact of overpressure credit, more information is needed than is provided
19 by design basis analysis, which contains much conservatism.

20 As a minimum, Reg Guide 1.82 should be revised to state that when credit
21 for overpressure is requested additional analysis should be done to provide more
22 realistic estimates of the actual amount and duration of containment overpressure

1 credit.

2 This information will provide us with margin -- understanding of margin and
3 a better understanding of the conditions we're meeting for our ECCS equipment.

4 Next page.

5 On the positive side, BWR Group is developing a more realistic
6 methodology for evaluating COP credit. We believe that the methodology that we
7 were presented and we have not reviewed yet, but it's promising. The concept is
8 promising. And then may provide, in fact, a solution, but of course, again it's
9 something that is an initiative of the Owner's Group. It's not a requirement. And
10 so, a licensee can use adoption of presenting that or it may not.

11 So, that requires still an understanding or maybe leveraging the Reg Guide
12 1.82 for placing some requirement therefore best estimate calculations.

13 We also have just received a white paper from the staff regarding this issue.
14 We have not had a chance to review it, but it's up for review and there's a lot of
15 good information there. It will help us, maybe. And with that, this concludes my
16 presentation.

17 DR. SHACK: Our final presentation is by Professor Abdel-Khalik on
18 the development of the TRACE Thermal-Hydraulic System Analysis Code.

19 DR. ABDEL-KHALIK: I will be talking about the development of the
20 TRACE thermal hydraulics code and the recently completed peer review. Next
21 slide, please.

22 In the mid-1990s a decision was made to consolidate the Agency's thermal

1 hydraulic analysis capabilities into a single code now called TRACE, which stands
2 for TRAC/RELAP Advanced Computational Engine.

3 TRACE is intended to serve as the main tool for confirmatory analysis
4 performed by the staff of a broad range of thermal hydraulic issues mainly design
5 basis accidents and transience before current light-water reactors. And with some
6 additional development it should also be usable for advanced light-water reactors.

7 The consolidation proved to be challenging as anticipated. The models,
8 correlations and solutions methodologies required in-depth review and
9 modification. And to that end, extensive validation was performed. Data from
10 about 500 experiments in 35 facilities were used for that purpose including both
11 separate effects tests and integral tests. Next slide.

12 Like others, ACRS was concerned about the rate of progress of TRACE
13 development. So, in our 2006 report on the NRC Safety Research Program we
14 stated that highest priority should be given to the integration of TRACE into the
15 regulatory process and that prioritization of technical improvements might be aided
16 substantially by commissioning a detailed peer review of TRACE. Next.

17 In a follow-up letter in 2007, the ACRS stated that the schedule for
18 documenting, validating and peer reviewing of TRACE should be accelerated and
19 that the work should be completed expeditiously.

20 Also, the development of a representative set of TRACE plant models and
21 user testing on applications should also be accelerated to facilitate timely
22 incorporation of TRACE into the regulatory process.

1 As a result, a peer review was performed by a group of four internationally
2 renowned experts in the thermal hydraulics area. The results of that review were
3 presented to us earlier this fall.

4 The conclusions of that peer review led us to make the following comments
5 that the recently completed peer review identified no major deficiencies that
6 preclude the use of TRACE for confirmatory analysis of postulated LOCAs in
7 current light water reactors, which was the scope of the peer review.

8 Several improvements have been recommended by the peer reviewers and
9 the staff has proposed a plan to address them. The ACRS agrees with the
10 recommended improvements and the staff's plan. These improvements include
11 improved documentation, additional assessment and modeling improvements and
12 corrections.

13 We further stated that significant progress has been made toward the
14 incorporation of TRACE into the regulatory process. Input decks have already
15 been developed for BWR 3, 4 and 5 plants, for Westinghouse 2, 3 and 4 loop
16 plants, for CE and B&W plants. Decks have also been developed for ESBWR,
17 AP1000 and EPR and decks for US-APWR and ABWR will be completed in 2009.

18 As stated earlier the peer review recently completed focused on the
19 applicability of TRACE to large break and small break LOCAs for current light
20 water reactors.

21 Further peer reviews should be conducted to evaluate the applicability of
22 TRACE to new light water reactor designs as well as for analysis of coupled

1 reactor physics and thermal hydraulics issues related to EPU's and expanded
2 operating domains.

3 Like other component oriented systems analysis codes, TRACE does not
4 correctly conserve momentum. Momentum conservation is more important for
5 passive systems where the driving forces are relatively small and need to be
6 accurately modeled in order to correctly predict the system response. Next slide.

7 We further recommended that the capability to evaluate uncertainties in its
8 predictions should be incorporated into TRACE. This is something that's now
9 routinely done in other codes and it should be doable for TRACE.

10 And finally, continued development of TRACE is necessary to keep pace
11 with evolving industry capabilities. These include the addition of a third fluid
12 droplet field so that it becomes a three-fluid model rather than a two-fluid model,
13 modifying TRACE to solve the conservative form of the momentum equation and
14 adding space or grid models.

15 That concludes my presentation.

16 DR. SHACK: Mr. Chairman, that concludes our presentations for
17 today.

18 CHAIRMAN KLEIN: Well, thank you for a good overview of three
19 very important subjects. We'll begin our questioning with Commissioner Svinicki.

20 COMMISSIONER SVINICKI: Mr. Chairman, I had not realized -- I
21 knew that Commissioner Lyons was traveling. We don't have a very complicated
22 algorithm here. When I go first, he goes last. So, it is Friday and rush hour starts

1 a little early. I'd be happy to switch places with you and you could go first, if that
2 would help you out.

3 COMMISSIONER LYONS: If you're willing, I'd appreciate it.

4 COMMISSIONER SVINICKI: I am willing and you'll do the same for
5 me sometime.

6 COMMISSIONER LYONS: Yes. I'd certainly start by thanking all of
7 you; excellent presentations on four complex subjects. Special thanks, Bill, to you
8 for your leadership and certainly you have left your mark on the ACRS and on
9 nuclear safety in the nation for many, many years. I hope you continue to do that.
10 Thank you very, very much.

11 Kristine caught me by surprise here, but let me recover.

12 COMMISSIONER SVINICKI: You mean you didn't expect me to be
13 nice?

14 [LAUGHTER]

15 CHAIRMAN KLEIN: Not on a Friday.

16 COMMISSIONER LYONS: I'm curious -- maybe I'll start with you,
17 Bill. You did talk about some of the challenges that ACRS will be facing. I was
18 just curious from your perspective of most recent leadership if there are any of
19 those challenges that you would particularly highlight as being ones that we should
20 focus on?

21 And also particularly wondering if there are ones in which the Commission
22 should be trying to in some way assist in your challenges more than we are doing?

1 Could you add anything more on the challenges?

2 DR. SHACK: Well, I think at the moment it really is just to fulfill our
3 duty to carry out a complete and thorough evaluation of the design certification in
4 the licenses and yet try to maintain the schedules that the Commission would like
5 to meet.

6 And again, there are challenges in the sense that we are dealing with
7 designs that are somewhat incomplete and that varies from design to design. We
8 haven't seen them all yet. We're wrestling with things like design acceptance
9 criteria rather than a completed design for something as important as the Digital
10 Instrumentation and Control Systems in a number of the reactors. And those are
11 policy decisions that the Commission has made, but it makes it more difficult to do
12 that.

13 I think our biggest challenge is just the sheer volume of the licensing work.
14 In the future, if the design centered concept holds and everybody seems to be
15 religiously adhering to that, although a number of our members are really skeptical
16 as to just how that can be done, but clearly that will make a difference. In the
17 meantime with as many new designs as we have on the plate at the moment.

18 And again, looking at some of our regulatory successes. License renewal, I
19 think, is a very good one where we have set up very clear expectations of what we
20 want. The licensees know exactly what to provide and by and large these go
21 relatively smoothly. There are always requests for additional information. There
22 are always issues that arise, but by and large they work well.

1 EPU, for example, I don't think we have quite as clear a set of
2 expectations either from the staff, from the licensee or from ourselves. Clearly,
3 applications in which we have topical reports supporting all the methods are easier
4 than ones where we have to make judgments on the methods as well as the EPU
5 itself. But that's kind of a decision that the licensee makes. Some licensees just
6 are supported by topical reports, others are not. It's a very much case by case
7 specific.

8 As we work through these things, clearly in all of these licensing actions,
9 the clearer the guidance and the clearer the expectations on everybody's part the
10 more smoothly things will go, but a number of these we're just working our way
11 through.

12 COMMISSIONER LYONS: Thanks for the comments. Another
13 question might go to Mike or maybe to Bill. On the ACNW merger, maybe it's
14 early to ask that question. I don't know that there have been issues yet that have
15 particularly fallen into the area that would have previously been with ACNW.

16 Are there any comments that either of you or anyone else would want to
17 make on how that merger has worked to date or am I just asking too soon?

18 DR. SHACK: Well, I think we're starting early. We had a very
19 interesting presentation yesterday as we started to look at some of the ICRP and
20 its implications for some of the regulatory process. As a committee that's our first
21 step into territory that was previously the domain of the ACNW. I'd certainly let
22 Mike address this since he's had a lot better view of it than I have.

1 DR. RYAN: I'd second your comment on the briefing. The staff gave
2 us a wonderful briefing on their plans forward to deal with the now arrived
3 ICRP-103 document. So, we're well on our way and I think it was a very engaging
4 conversation for all the members of the ACRS.

5 In addition, I'd like to credit the staff of the ACRS who are now staff -- staff
6 of the ACNW who are now staff of the ACRS. The fact that they are working
7 collectively with the staff who are really mainly focused on the ACRS side and are
8 integrating the preparatory work for all of our meetings and all the members is an
9 excellent asset to the effort. And I'm happy to tell you so far it's been a very
10 rewarding experience and I imagine it will continue to be so as we continue the
11 integration process.

12 COMMISSIONER LYONS: I'm glad to hear that. I think that was an
13 important step to combine the committees and I look forward to that kind of
14 successful integration.

15 DR. RYAN: Thank you.

16 COMMISSIONER LYONS: A question for Dr. Banerjee. Certainly, I
17 appreciated your view that the staff has a systematic closure process for the
18 GSI-191 in progress.

19 A specific question happens to be on slide 18, but you referred to the
20 changes that some licensees have made in areas like chemical buffers and other
21 water management strategies.

22 I just am curious if in your view such changes are being made -- let me say

1 with a holistic strategy -- as opposed to being a fix for GSI-191. I hope that any
2 changes in something as important as water chemistry are being looked at in a
3 carefully reasoned and again overall view. Would you have an opinion on that?

4 DR. BANERJEE: My impression - and I think I speak for the
5 committee on this - is that they have been looking at the broader implications. So,
6 if you just change out a buffer, even if you remove a buffer, imagine -- nobody has
7 removed a buffer yet, there are many implications obviously of doing that. As far
8 as we can tell these are being systematically evaluated, so it's not an ad hoc
9 measure to try and take care of the problem.

10 Of course, removing and replacing insulation -- if you take fibrous insulation
11 out, this has no broader implications like water management and the buffers. So,
12 my answer to that question is, so far as we can tell, this is being managed in a way
13 which takes into account the broader implications of such changes.

14 We haven't seen anything at the moment which would suggest that there
15 might be other outcomes which are less desirable.

16 COMMISSIONER LYONS: I appreciate your comments and I hope
17 that the committee and the staff do continue to watch that any changes that are
18 made in such a critical area are made carefully.

19 Mario, I very much appreciated your discussion on power uprates and
20 particularly the issues on the NPSH. It was in preparing for this meeting that I
21 frankly began to appreciate a little bit more how complex an issue this is and the
22 magnitude of the difference of opinion that is, I think, ongoing between the ACRS

1 and the staff in this area.

2 I didn't read, not yet completely, the recent staff paper in this area, which
3 again brought home to me that the guidance from both ACRS and I think the staff
4 has changed and to some extent vacillated back and forth.

5 I'm certainly not to the point of having an opinion of my own on this yet. I
6 want to do more study. But I am curious if from your perspective you could
7 suggest any perhaps experimental tests that the Commission could be supporting
8 that might lead to improved resolution of some of the differences of opinion here?

9 Just in general, I'm interested in what are the next steps. I understand that
10 staff and the committee at least with the current viewpoints are not in alignment.

11 DR. BONACA: Well, let me just say that clearly we're talking about
12 two different separate issues that get together and we get intermingled. One is do
13 we have sufficient margin to cavitation as I said before? And that's really a
14 technical issue. What is necessary there to feel comfortable?

15 One issue is how long can you trust that the containment will hold
16 pressure? We don't know really what kind of experiments have been done on the
17 seals and so there are a number of issues that can be explored. I'm not sure that
18 they've been explored sufficiently.

19 The other one is how do you make a determination that in fact the margin is
20 sufficient? I spoke of that issue because hopefully we're not really on a very
21 different page. The calculations that are being done for example, for the LOCA if
22 you do one with the best estimate we would expect to see consistently reduction in

1 the amount of time for which you need credit as well as the amount of credit that
2 you need. So, that's a second issue. The issue is how do you evaluate this thing?

3 Regarding the work with experimental work, again, one that could be
4 convincing would be work that is done to understand how long the containment will
5 hold under the condition that you have in the LOCA event, for example, that drags
6 on for hours or days.

7 COMMISSIONER LYONS: Well, I'd certainly be very interested as
8 this discussion between ACRS and staff continues for suggestions from I guess
9 both of you or either of you as to experimental programs that might give a greater
10 confidence in this key area.

11 And again, I had not realized until preparing for this that this is an issue of
12 such significance. So, I appreciate that.

13 DR. BONACA: I think what is also disturbing somewhat is that as we
14 lose margin to cavitation more and more is being done to discuss how the pump
15 should be capable of extending cavitation, materials should be used that withstand
16 cavitation, and so on and so forth.

17 We become used to the concept that you really can learn the equipment
18 like this which is safety equipment in cavitation conditions. That, to me -- and this
19 is just my view, not the committee necessarily -- but it troubles me when we move
20 the debate to a level of detail where we almost try to demonstrate that that level of
21 degradation is tolerable.

22 And that's really what troubles me that in some cases clearly we are likely

1 to have some cavitation there and we're potentially compromising this important
2 equipment that we have.

3 COMMISSIONER LYONS: Thank you. Thanks to Kristine for her
4 generosity. I will duck out in just a few minutes. Thank you very much.

5 CHAIRMAN KLEIN: Commissioner Svinicki?

6 COMMISSIONER SVINICKI: I think the deal is that I go last now.
7 We swapped, so that way I don't bump the two of you.

8 CHAIRMAN KLEIN: I was going by my list.

9 COMMISSIONER SVINICKI: Is the algorithm more complicated than
10 I thought?

11 CHAIRMAN KLEIN: In the algorithm it just goes back to the top, so
12 now you get to start again and then I go. So, we just sort of rotated.

13 COMMISSIONER SVINICKI: Okay. That's fine. I will help out here
14 because I don't have too much. I thank you all for your presentations. Since I
15 have the shortest tenure here, I'm still studying up on my history. And what's been
16 fascinating to me is on Monday I was at Fermi and so I had an opportunity to go to
17 Fermi 1.

18 The history of the ACRS is so interesting. It has run parallel to the history
19 of atomic energy in this country. Even though DOE and NRC have had a name
20 change, you all have a direct lineage back and it's a very storied history and like I
21 said runs parallel to the Commission's history as well and it's fascinating.

22 At Fermi 1, the reason I'm mentioning that is it was a very interesting time

1 between the PRDCs -- at the Power Reactor Development Corporation, the
2 ACRS, the Atomic Energy Commission and the Congress. Anyway, it's a
3 fascinating history, but I think ACRS has such lineage.

4 And for those of you who serve on the committee now you're part of that
5 long history that reaches all that way back. I thank you all for being a part of that.
6 As a Commissioner the work the ACRS is important to me and I think that the
7 framers of the Atomic Energy Act realized that another committee, another body of
8 technical experts that could look at these issues would help with public confidence
9 in embarking on new technologies. And so, I can't help but reflect on that a little
10 bit.

11 This is my second meeting with the ACRS, but I appreciate very much all
12 you do and your work product is eagerly consumed by me and I'm sure my
13 colleagues as well. So, thank you all for the work you do.

14 I was going to touch on something that Commissioner Lyons had touched
15 on, the list of work and ongoing projects. I was flipping through this yesterday
16 afternoon or evening and I kept flipping pages and it was your task list. It's very,
17 very long.

18 You did have a specific comment I think it was about the ESBWR and in
19 your conclusions and recommendations in your letter report you say, "The evolving
20 nature of the ESBWR design makes it difficult for the staff and the ACRS to
21 perform an efficient review." I think that the review chapter by chapter, I think, is
22 constructive and helpful. Is there anything that can be done?

1 There's a lot of moving pieces here for ACRS and ACRS members as they
2 try to do these reviews. Is there anything, other than noting the challenge, is there
3 anything that you could suggest other than things should be, I guess, complete
4 and finalized; the sooner the better.

5 [LAUGHTER]

6 DR. SHACK: I will ask our subcommittee Chairman Dr. Corradini.

7 CHAIRMAN KLEIN: It's always risky to have Dr. Corradini because
8 his training is 50 minute increments.

9 DR. CORRADINI: So, let me repeat the question. That's a good
10 academic way of trying to slow it down a bit. Your question is: Are there ways to
11 deal with it more efficiently?

12 COMMISSIONER SVINICKI: It is highlighted again in the letter
13 report. It's dated July 21st of this year. It's under, again, conclusions and
14 recommendations section that's meant to highlight, I think, things for the
15 Commission's attention or others who are learning about your review.

16 You highlight as the very number one item the evolving nature of the
17 ESBWR design makes it difficult for the staff and the ACRS to perform an efficient
18 review.

19 I wondered if attendant to that you had any suggestions or, again, because
20 the section is also recommendations. Is there any way to -- is it that you're looking
21 chapter by chapter and the chapters are not complete enough? Is there anything
22 in terms of the process that would help?

1 DR. CORRADINI: I'll preface by saying I will give you my opinion
2 because I have 14 energetic people around me that will get me if I give a
3 committee opinion.

4 I think the essence of it and I think actually Chairman Klein hit me with this
5 one 6 months ago. I think that the design itself is relatively -- I'm looking for the
6 right word here -- is relatively broad in its current state and details are yet to be
7 seen in certain areas; for example, Digital I&C.

8 We see functional requirements. We see general principles. We don't see
9 detailed design. That makes it difficult for the staff to evaluate certain things and
10 us as reviewers of the staff's conclusions difficult.

11 So, I think it's the level of detail design is really what we're getting at there.
12 It's very detailed in some areas. It's not so detailed in others. Some just simply
13 have specifications and broad principles because of the DAC process, the Design
14 Acceptance Criteria process. I think that kind of goes to the essence of the
15 conclusion. I'll look to colleagues if I've missed it, but I think that's really what we
16 meant.

17 COMMISSIONER SVINICKI: Okay. My follow-up then would be
18 because you are and the committee is engaged in a chapter by chapter review
19 and I think that was done to facilitate that all the pieces are not in place at any
20 given time. I consider it accommodation on the committee's part to be willing to do
21 that. It's certainly not the easier of the two ways to review a design. If you had the
22 entirety of the thing that would be easier for you.

1 Is that somewhat a condition then upon your reports and conclusions? Are
2 you basically forewarning me that as I review things you've highlighted the fact
3 that you did not have the completeness you might have desired? Is it a condition?
4 Are you tempering your conclusions?

5 DR. CORRADINI: I would say based on all the conclusions -- we've
6 had five interim letters -- we've tried to be -- and let me again preface by saying I
7 think the staff has been very good at interacting with us at subcommittee meetings
8 about all the various chapters, whether it be things relative to vessel design,
9 emergency core cooling systems, containment performance, et cetera.

10 So, we've had ample chance to at least understand what the design is and
11 comment on things that concern us. I think when we've asked for certain details it
12 kind of rolls back to the details of the design and there are still some open issues
13 that we're waiting to hear back from the applicant to make sure we understand
14 what the analysis is, the detail of the analysis, so we feel comfortable that we have
15 enough to ensure adequate protection on certain issues.

16 COMMISSIONER SVINICKI: That's helpful because I think what
17 you're telling me is it's more of an explanatory note on the timing of getting to close
18 out chapter by chapter versus a caveat overall to say our conclusions, our
19 conditions because we don't have completeness.

20 DR. CORRADINI: I'll again say that each one in some sense we've
21 tried to be clear about what we're looking for and in the one that you had
22 mentioned, I think this was the fifth letter relative to certain things, for example, on

1 beyond design basis events., there are certain things, either analysis or
2 experiments, we're waiting to see so that we can be clear about the performance
3 of the system.

4 COMMISSIONER SVINICKI: Okay. Thank you. And then on the
5 topic of the TRACE code. It's interesting because it was the first time that I had
6 heard what that acronyms stood for and it was ironically -- it's the worst kind of
7 offense that this is just a personal peeve, acronyms within an acronym. I knew
8 when I smiled about it and I looked at you Dr. Shack you had the same look.

9 And then to compound the issue it is not listed in your abbreviation chart.
10 There is neither TRACE nor the embedded acronyms listed there, so it was a
11 hopeless task for me to try to figure that out on my own.

12 DR. ABDEL-KHALIK: I thought it would be interesting to let you
13 know what TRACE stands for.

14 COMMISSIONER SVINICKI: Thank you for verifying. It was all my
15 worst suspicions come true.

16 I would ask you again there -- this has been kind of a long-term effort and
17 based on your presentation and the materials we were provided I think I
18 understand where we're headed with it.

19 Is there anything more you could tell me in terms of resourcing it? We want
20 to be able to incorporate it more into our analysis and our framework. Is it
21 something that could proceed more at pace or could be accelerated or improved in
22 our approach?

1 You gave a great status, but as far as looking forward from here any
2 suggestions you might make on it of things that staff could be doing more quickly
3 or more thoroughly? Did you have any recommendations along those lines?

4 DR. ABDEL-KHALIK: I think the recommendations of the peer
5 review group should be completed as quickly as possible and we agree with that.
6 But in addition if we are to use TRACE to analyze some of the transients for the
7 passive safety systems in advanced light-water reactors then it is very important to
8 proceed with the improvements in the code, primarily making the code conserve
9 momentum because in a normal light water reactor where there are pumps driving
10 the flow one is not terribly concerned about exactly conserving momentum.

11 But when the driving forces for gravity driven protection systems are so
12 small it is very important to be able to conserve momentum in order to be able to
13 predict accurately how the systems will perform.

14 So, I would place that on the top of the agenda as far as proceeding with
15 further developments or further improvements in TRACE.

16 COMMISSIONER SVINICKI: Okay. Thank you. That's very helpful.
17 Thank you, Mr. Chairman.

18 CHAIRMAN KLEIN: Well, again, good presentations by all. I was
19 going to ask the same question that Commissioner Lyons asked and it was about
20 the merger between ACNW and the ACRS. I'm glad to hear that's going well. So,
21 my compliments for the merger of those two.

22 One question, Bill, for you. Now that you've look at a few applications,

1 obviously you're going through some of the design certs, unfortunately chapter by
2 chapter for some cases.

3 But in terms of the COLs could you talk about the quality of those in terms
4 of do you think they're good quality? Do you think there's a pattern of getting
5 better or anything?

6 DR. SHACK: We haven't started on the COLs yet. That's to come.

7 CHAIRMAN KLEIN: You haven't looked at any of those yet? How
8 about of those applications you've looked at today? Any patterns?

9 DR. SHACK: You mean for things like early site permits?

10 CHAIRMAN KLEIN: Right. Early site permits and design certs.

11 DR. SHACK: I think the early site permits have been fairly good.
12 Our reviews have been fairly favorable of those. The design certifications - we've
13 talked about our problems with ESBWR. In all fairness, this seems to be a more
14 complete design with the APWR and again there seems to be a great deal of
15 information that we're just barely beginning to get in to. Again, it just looks as
16 though it will go better.

17 COMMISSIONER JACZKO: There's no DAC. I think in APWR the
18 goal is for there to be zero DAC. So, that may be helpful to the committee in
19 particular.

20 DR. SHACK: Yeah, it's a goal, an aspirational goal, I think, sounds
21 like a good idea. There will be clearly fewer DAC.

22 COMMISSIONER JACZKO: Fewer DAC. But I think the goal,

1 unless I'm incorrect, the goal is no DAC.

2 DR. SHACK: That's what we've been told.

3 COMMISSIONER JACZKO: That's what I've been told as well. So,
4 that's good. We've been told the same thing. Sorry, I didn't mean to interrupt you.

5 DR. SHACK: I was just going to ask Dr. Powers if he wanted to
6 make any comments about the EPR. No?

7 Again, we believe that's probably a more complete design and so we're
8 expecting a relatively more straightforward way to review it.

9 CHAIRMAN KLEIN: Thanks. Commissioner Svinicki had also noted
10 that your workload is rather challenging. Any major scheduling issues?
11 Obviously, it will be a challenge to work all the schedules. You mentioned some in
12 parallel, but any major hurdles that you foresee?

13 DR. SHACK: No, I think you never really know what a schedule
14 looks like because we're all geared up and then somebody else slips. We've been
15 waiting for Browns Ferry. It's this month, a month later. And so, I expect all these
16 schedules to slip and I think it's something that our staff has been very good at
17 coordinating with the different offices.

18 I think what's really important is that we just sort of all keep ourselves
19 abreast of where the other person is and just try to coordinate these, recognizing
20 that the planning that's going on is good, but it's certainly going to be changing as
21 things develop here.

22 CHAIRMAN KLEIN: I think the challenge and you commented on

1 the designs when you look at the license renewals, for example, that one has been
2 more predictable. Design certs and COLs, they're a lot more unpredictable events
3 there whereas when we look at license renewals, we know when they're coming,
4 they're much more predictable. So, I'm sure your flexibility is going to be
5 important.

6 Dr. Banerjee I was glad to see we're making progress on the sump issue.
7 Do you foresee any other technical challenges that sort of may be lurking there
8 that we haven't focused on yet?

9 DR. BANERJEE: Let's hope not. This issue, of course, has a habit
10 of some unexpected phenomenon rearing its ugly head. So, you never know. I
11 personally -- this is my personal view -- hope that most of these we've seen by
12 now.

13 And if that's the case then provided we're diligent and do things
14 systematically I would hope that we can close it out by the end of 2009 or
15 something like that.

16 If something unexpected happens, say chemical effects become much
17 more important than we expect for the core or something like that, that could set it
18 back.

19 We keep discovering as we go along new things and the predictability of
20 this is not all that high, because of the complexity. So, I'm hopeful, but you can
21 never tell with this one.

22 CHAIRMAN KLEIN: Thanks. Well, I've got the question that you've

1 gone through. It seemed like the area that you described, Mario, that there are
2 some back and forth between ACRS and the staff on overpressure and things of
3 that nature.

4 I noticed on page 35 that you talked about analysis of over pressurization
5 when small and duration is limited. Have you quantified what those numbers are?
6 Either ACRS or the staff.

7 DR. BONACA: We have stated simply small, which means just a
8 few pounds and duration limited to a few hours. We didn't go any further beyond
9 that.

10 Again, as I said before its a soft criteria that we set up in a letter, but we
11 were begging for a criteria on something that is a common basis for making a
12 judgment so that from application to application we have something we can
13 depend on rather than seeing always some other solution or judgments being
14 made that challenge us because we don't understand what the basis is.

15 We certainly feel, for example, under our scenario almost 10 psi for up to 69
16 power hours is a long time. It's three days. Again, we don't have anything
17 quantitative that we can say we have a technical basis for. It's more a concern
18 with defense in depth and concern with margins.

19 CHAIRMAN KLEIN: Thanks. On slide 42 in your conclusion slide, it
20 looks like you have sort of some suggestions. If the staff accomplishes those do
21 you think you will converge more on the issues?

22 DR. BONACA: I think so. For example, for the Browns Ferry large

1 break LOCA transient, I do believe that we probably can conclude if we have a
2 realistic calculation there that it's acceptable because we expect that -- we are
3 aware of the conservatism that comes with a design basis analysis of a LOCA.
4 There's a lot of conservatism that can be reduced in a realistic calculation.

5 We don't know right now because we don't have that information. All we
6 have is a design basis calculation that shows a required margin for roughly 19
7 hours. Nineteen hours is close to a day. I think that will certainly help us very
8 much.

9 CHAIRMAN KLEIN: So, I assume that you sort of think that you
10 have a convergence plan in mind between ACRS and the staff?

11 DR. BONACA: Well, definitely we need, as I said, to bridge our
12 gaps. I think the challenge is going to be, for example, Reg Guide 1.82 should be
13 revised to state why credit overpressure is requested and additional analysis
14 should be performed to be more realistic. I don't know what the ability of the staff
15 is to expect that of a licensee.

16 DR. SHACK: We should also note that we have received that white
17 paper and they are proposing some revisions to the Reg Guide that we have to
18 review. At least at first glance appear to be directed to a convergence of views.
19 Again, we just got that. This is a 10 minute --

20 DR. BONACA: I think it is in part that we also have to converge on
21 agreeing what is an acceptable criteria of some type. The staff seems to have
22 become more comfortable with granting credit because they have done many of

1 these applications and they make judgments on a case by case basis.

2 For us, it's more the issue of margin. We need to feel comfortable on
3 margin. Again, the point I made before that it troubles me at least personally that
4 oftentimes we get into the issue of cavitation. Cavitation is okay, the pump should
5 be able to do it. They cavitate for 10 hours, but they've shown -- actually for 10
6 minutes, but they've shown the pumps can take it and so on and so forth.

7 Well, that's not the way of thinking that we should use too much because
8 that's a challenging environment for those pumps. Those pumps are critical to the
9 mission that we have designed them for.

10 CHAIRMAN KLEIN: Thanks. Said, a question for you. Obviously,
11 now that we all know what TRACE sort of stands for and we'll, I'm sure, continue
12 to use that acronym a lot more. Have you looked at cases in applications where
13 TRACE is acceptable and where cases that it's not acceptable?

14 DR. ABDEL-KHALIK: The peer reviewers have and they have
15 primarily focused on the use of TRACE for large-break LOCA and small-break
16 LOCA for current light-water reactors and based on that review they have
17 concluded that there is nothing that would prevent the successful application of
18 TRACE to those applications.

19 However, there are a lot of other things that we would like to use TRACE for
20 and for that there are a lot of recommendations that the peer review has made and
21 there are additional long-term modifications that need to be made in order to be
22 able to use TRACE for the full complement of design basis accidents and

1 transients for both light-water reactors and advanced light-water reactors.

2 CHAIRMAN KLEIN: Great. Thanks. Commissioner Jaczko?

3 COMMISSIONER JACZKO: Well, maybe I'll just follow up on that
4 question. Again, you said that the momentum conservation is a problem and that
5 obviously presents a problem for the passive plants. Did the peer review
6 specifically find that TRACE was acceptable for the passive plants?

7 DR. ABDEL-KHALIK: No, that was not the scope of the peer review.
8 The scope of the peer review was specifically limited to the application of TRACE
9 to large-break LOCA and small-break LOCA in current designed light-water
10 reactors.

11 COMMISSIONER JACZKO: In the committee's opinion is it being
12 used or is it acceptable? If it's not acceptable for passive plants, what's being
13 used?

14 DR. ABDEL-KHALIK: Right now we don't know, but intuitively if you
15 have a tool that does not conserve momentum and you know that momentum
16 conservation is very critical to predict the performance of the system when the
17 driving forces are very small, then by gosh we ought to make sure we have the
18 right tool to do the job.

19 COMMISSIONER JACZKO: What are we using currently to do that
20 analysis for the ESBWR and AP1000?

21 DR. ABDEL-KHALIK: There are codes similar to the current version
22 of TRACE that are being used. You can use a code to do anything. The question

1 is whether or not you believe the outcome. In my view, until and unless this
2 momentum conservation issue is resolved I would not believe the results of
3 TRACE or any other code that does not conserve momentum.

4 COMMISSIONER JACZKO: Maybe we can get this from the staff
5 later then, or if someone's here that can say to what extent TRACE is in fact being
6 used. Do you know if it's being used in the ESBWR analysis and the AP1000?

7 DR. ABDEL-KHALIK: Well, the decks have been prepared. I'm not
8 sure if any confirmatory analysis have been performed yet, but there are decks for
9 the ESBWR, the AP1000 and the EPR. The decks for the US-APWR and the
10 EBWR will be completed in 2009. So, we have the Decks, but I'm sure not sure if
11 any detailed analysis have been performed.

12 COMMISSIONER JACZKO: It's probably an issue we need to put to
13 rest sooner rather than later.

14 Turning back then to another issue that Commissioner Svinicki raised on
15 the issue of the review of the ESBWR. Mike, if you want to comment on this or
16 anybody does. I think perhaps just to clarify my understanding.

17 The committee will review the final SER and all chapters, so these are just
18 the preliminary reviews and there will be at some point hopefully a final SER that
19 will be complete and then the committee can review. I just wanted to clarify that
20 and make sure we don't have that problem.

21 I wanted to turn to the issue the Chairman raised -- well, actually, I think
22 everyone has raised on GSI-191 and the closure of that. I had a briefing from the

1 staff a while ago -- actually, not too long ago, but a couple months ago and they
2 sent me a summary of where we stand right now in terms of resolving this issue.

3 I don't know if you have all seen this, but you probably have seen
4 something similar. Right now we have one plant that is complete and that's Davis
5 Bessie and it's largely, I think, a result of other issues they have addressed
6 problems with sump performance in a satisfactory way. So, they're satisfied.

7 Other than that we have -- and this is as of October -- 37 of 69 plants
8 believe that they're complete. The staff doesn't yet. Although maybe in some of
9 those cases the staff is comfortable that they're complete. So, I'm not quite so
10 confident that we are fully on top of this issue yet.

11 Every time I talk to the licensee they tell me that once we get the chemical
12 effects issues resolved then we think we'll be done. And then I ask them how
13 that's going and they say we're waiting to hear to make sure we have acceptable
14 methodologies and analysis from the staff.

15 So, there still seems to be a lot of uncertainty about how we do that and, of
16 course, all of that is neglecting the downstream effects, which the committee has
17 continued to raise. I think several years ago when this first kind of came up to my
18 attention the staff made a decision that they weren't terribly concerned with the
19 downstream effects for PWR in particular.

20 So, I think that's an important issue we need to put to rest, but I think as far
21 as the staff is concerned I think their approach is to resolve the chemical effects
22 and the mechanical effects and deal with the downstream effects perhaps a little

1 bit later.

2 It is an area where -- I don't necessarily have a question in here unless
3 anybody wants to comment. As I said, I'm not necessarily so sure that we're that
4 far and I'm not quite comfortable that we have a clear closure path yet to get there.

5 I perhaps do have a question in this regard. And that is, what seems to
6 have come out of this issue, Dr. Banerjee started by giving some of the operating
7 experience from the BWR side, which was then resolved to the satisfaction of the
8 staff previously.

9 The thinking seems to be now that what we've learned on the PWR side
10 may call into question what we know about the BWRs and in particular that the
11 downstream effects may play more of a dominant role because of the BWR fuel
12 design.

13 Maybe you could comment if the committee intends to look at the BWR side
14 and what the plans are to address that or will you follow the owners' group activity
15 in that regard?

16 DR. BANERJEE: So, I think if I understand you right, really, you
17 have one implicit question and an explicit one. So, let me try and answer the
18 implicit one first which has to do with the state of the PWR business.

19 For low fiber plants and plants which I think don't require credit for settling
20 and things like this, the path forward to closure is there. The staff is looking at the
21 tests they've done. The protocols and so on are relatively clear. I think using
22 these surrogates like the Westinghouse surrogate for chemical effects we feel

1 fairly confident that they are conservative, if anything.

2 So, for these types of plants my sense is that in spite of this list being so
3 long that you're going to see closure coming along. Leaving aside downstream
4 effects, I'll visit this in a moment. With the high fiber plants and if the insulation
5 hasn't been changed or something is being done about this and lots of credit is
6 being taken for settling and so on this is going to be a much more contentious
7 issue.

8 The staff is trying to develop appropriate protocols for the testing. It's very
9 hard to simulate the conditions in the plant in a relatively small-scale test in terms
10 of turbulence, settling, all these types of parameters.

11 COMMISSIONER JACZKO: Why isn't the right answer to take that
12 category of plants and put them into the category of other plants, namely change
13 out fibrous -- I think Carl Paperiello told me this once at the very beginning of this
14 issue when he was still the Director of the Office of Research. He said, "The
15 chemical effects problem is probably going to require a chemical solution, which
16 means you change some of the chemicals." Nobody's really going that way right
17 now.

18 DR. BANERJEE: They're changing out to tetra borate.

19 COMMISSIONER JACZKO: Okay. So, they are making some
20 changes. Or the other thing you can do is remove fibrous insulation. Why isn't
21 that just the solution for that other category of plants?

22 DR. BANERJEE: Well, first of all, it's expensive, I imagine, to do

1 that. If you can avoid having to do very extensive changes to insulation that may
2 not be easy to do all of it and you can still maintain acceptable performance, I think
3 one will try to do that.

4 Now, I think what the staff is looking for is a success path. They're not
5 looking for people to try something and perhaps the staff should speak to this
6 rather than me because I'm talking about what they're doing.

7 They're looking for a success path. They've asked the licensees to come
8 forward with whatever management schemes they have that changes things out
9 because there's all sorts of possibilities here, which will give them a high possibility
10 of success rather than keeping on trying different -- coming forward with things
11 that don't work.

12 So, there's a second category of plants and I agree with you, if they
13 removed all the fibrous stuff and change out the buffers to tetra borate or
14 something they're going to be relatively -- go into the first category. So, the
15 challenge is with the second category of plants.

16 The other problem with regard to downstream effects, which we've been
17 very concerned about for a long time, is that the tests that are being done should
18 be complete enough to come up with a topical of some sort which can be
19 approved. Once that's done if a licensee can demonstrate that they fall within the
20 aegis of this topical then by reference to this they'll be able to get closure on this
21 downstream effect.

22 The real issue here is whether you can accumulate, of course, something

1 which gives you almost 4 psi pressure draw. You'd think this is very difficult, but
2 these tin beds tend to have this type of behavior even if you don't carry too much
3 stuff downstream. That's the real concern here.

4 I think, personally, that the downstream effect will be resolved, but we want
5 to make sure that a wide enough series of tests are done to take into account most
6 of these conditions that can arise.

7 The industry group is going to have to do this and satisfy the staff and us at
8 the end that they've done a good job. We're trying to help them to define these
9 tests.

10 DR. SHACK: I want to make one comment. You don't want to
11 confuse the fact that the solution may be satisfactory, but the tests that you've
12 done to prove that it's satisfactory is not adequate. We're talking about here is the
13 test. Whether or not they've solved their problem is an unknown at the moment
14 because we don't know whether the test is adequate or not.

15 I think the same way when we say the chemical problem is solved that is
16 that the staff and we agree that they have ways to do chemical tests, whether
17 everybody's chemical test has been a satisfactory chemical test.

18 COMMISSIONER JACZKO: And in some cases it hasn't.

19 DR. SHACK: It's a different question.

20 COMMISSIONER JACZKO: I think that's one of the problems, I
21 think, in some cases the chemical of the integrated effects testing, which then
22 incorporates the chemical effects have shown that there has been head loss. And

1 then the question I think has become is that because the solution is unsatisfactory
2 or because the testing protocols were unsatisfactory? That is the problem that
3 people are trying to work through right now.

4 As I said, I think it does concern me that we're not close perhaps yet to
5 getting that second category of plants resolved. Maybe you could comment briefly
6 on the BWR side.

7 DR. BANERJEE: Sorry, that was the second question.

8 COMMISSIONER JACZKO: I hit you with a long one and as you
9 said it was an implicit question rather than an explicit one.

10 DR. BANERJEE: The second question, as I understand it, the issue
11 is -- one is going to look at -- the staff is going to look at BWRs and determine
12 whether there are any issues that arise out of what we've learned now with PWRs
13 and revisit it. Things like downstream effects, as you said. We'll see what comes
14 out of that.

15 It might be necessary to reopen it or not depending on what they find and
16 hopefully they will come to us. I think they do come to us at every stage and we
17 interact with them.

18 COMMISSIONER JACZKO: I certainly would encourage that
19 because I think your input in this has been extremely valuable and this goes back,
20 Bill, to -- we talked today about ending your term as Chairman. This goes back to
21 when Graham Wallace was Chairman, I think, and he certainly brought down
22 stream effects to the committee's attention. So, this is not a new issue in many

1 ways for us. It's one that I think is important to get resolved.

2 If I could briefly turn to the containment overpressure issue. We had a
3 discussion on this at the last ACRS meeting and it was a good discussion. And
4 again, I think it's an important issue. At that time the Commission asked the staff
5 to give them some policy papers. Perhaps we weren't clear enough on that.

6 I think this one is one I certainly will push that we get a paper for the
7 Commission, I think, to make some decisions in here because I think the
8 committee has repeated its concern with this issue. The staff appears to have
9 taken a different position and I think this one may be one where the Commission
10 just needs to weigh in and make a policy decision here essentially to that point that
11 you raised, which is what is -- if there is an acceptable duration and an acceptable
12 amount of overpressure or not. If there is, what would those values be?

13 I think the committee has done a very good job in this regard in bringing
14 these issues to our attention. I think at this point it's on the Commission now to
15 make some decisions here and figure out what we need to do because I think
16 that's really where we're at is making a policy call here on what is the right analysis
17 approach.

18 If I could just briefly turn to one last issue, which again I think falls into this
19 category where we have some disagreements from the staff and I have to admit
20 I'm not as familiar with the technical aspects of it. Perhaps you could comment on
21 where you stand with the Susquehanna uprate as well.

22 I know there continues to be a back-and-forth there with the staff. I don't

1 know if that's out of the blue for anyone.

2 DR. BANERJEE: I guess -- am I elected on this one? With
3 Susquehanna, the issue as you mentioned relates to the operating limit CPR. This
4 has to do with what happens during a transient, such as a turbine trip with or
5 without bypass. I think the issue was that if there was an uncertainty in the void
6 fraction correlation that is used in doing these calculations that there could be
7 sufficient uncertainty in the outcome that some penalty should be put on the OLM
8 CPR until such time as this calculation was done.

9 Now, with regard to Susquehanna, that's what we recommended. The staff
10 looked at it and they said well, you know, we feel the uncertainties are less,
11 therefore it was acceptable. But, of course, this issue will come up with every
12 EPU.

13 So, what we've suggested is that they do some calculations. We did some
14 very preliminary calculations to look at these uncertainties and as far as I know
15 there are a set of calculations which are being done or have been completed,
16 which hopefully we'll get to see eventually.

17 It could well be that there is no issue at all. Or it could well be that there is
18 an issue. It's very hard to know the outcome. The problem is it's a very
19 complicated situation. If you have, say, less or more void when you trip a turbine
20 this collapses, there is a reactivity pulse which then gives rise to voiding, which is
21 lagging this reactivity pulse, the power pulse.

22 So, the whole sequence of events is a combined neutronic thermal

1 hydraulic event and then when the void fraction is the highest in the core after this
2 pulse what effect does that have on the critical heat flux which is also a transient
3 problem? This is why there are differing opinions on this. We need to resolve
4 these with some good calculations.

5 COMMISSIONER JACZKO: Again, I would say I think this is an
6 important issue and the committee has brought this, I think, to the staff's attention
7 and to our attention as well. I do expect the staff will work with you to provide -- I
8 guess Research has done some work at this point.

9 DR. BANERJEE: They did some preliminary analysis which
10 suggested that some more analysis should be done. As far as I know, it's going
11 forward.

12 COMMISSIONER JACZKO: Okay. I appreciate that.

13 DR. BANERJEE: We'll see what happens.

14 COMMISSIONER JACZKO: Thank you. And again, I appreciate all
15 of your efforts and Bill, appreciate your serving as Chairman for a time. We
16 appreciate all the hard work of the committee. Thank you.

17 CHAIRMAN KLEIN: Well, thanks specifically for the presentations
18 today and your efforts. Obviously, your workload is challenging. As we've noted,
19 this is an exciting time to be in the nuclear business. It's very dynamic and so I
20 think you'll find a lot of challenges in the upcoming months.

21 Again, appreciate your work, Bill, for your activities and as Commissioner
22 Lyons said we hope your continued service.

1 DR. SHACK: Thank you.

2 CHAIRMAN KLEIN: Thanks for all of you on the ACRS for giving us
3 independent advice so that we can keep our focus both for independent and
4 strong technical analysis on safety and security. So, thanks for all the members
5 for all the work you do. Meeting is adjourned.

6

7 (Whereupon meeting was adjourned.)