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

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS:

DR. WILLIAM SHACK, Chairman

DR. SANJOY BANERJEE, Member

DR. MARIO BONACA, Vice Chairman

DR. SAID ABDEL-KHALIK, Member

DR. MICHAEL RYAN, Member

DR. GEORGE APOSTOLAKIS, Member

P-R-O-C-E-E-D-I-N-G-S

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.

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

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.

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

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.

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.

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.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

is entrained.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Guide.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

credit.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

reactor physics and thermal hydraulics issues related to EPUs and expanded operating domains.

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

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

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

That concludes my presentation.

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

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

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

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

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

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

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

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

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

[LAUGHTER]

CHAIRMAN KLEIN: Not on a Friday.

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

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

Could you add anything more on the challenges?

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

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

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

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

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

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

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

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

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

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

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

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

DR. RYAN: Thank you.

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

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

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

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

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

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

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

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

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

and the staff in this area.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CHAIRMAN KLEIN: Commissioner Svinicki?

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

CHAIRMAN KLEIN: I was going by my list.

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

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

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

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

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

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

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

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

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

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

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

[LAUGHTER]

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CHAIRMAN KLEIN: I think the challenge and you commented on

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CHAIRMAN KLEIN: Great. Thanks. Commissioner Jaczko?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

bit later.

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

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

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

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

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

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

fairly confident that they are conservative, if anything.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DR. SHACK: It's a different question.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

COMMISSIONER JACZKO: Okay. I appreciate that.

DR. BANERJEE: We'll see what happens.

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

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

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

DR. SHACK: Thank you.

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

(Whereupon meeting was adjourned.)