UNITED STATES OF AMERICA

U.S. NUCLEAR REGULATORY COMMISSION

MEETING WITH ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS) AND BRIEFING ON DESIGN ACCEPTANCE CRITERIA

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TRANSCRIPT OF PROCEEDINGS

Public Meeting

Before the U.S. Nuclear Regulatory Commission:

Gregory B. Jaczko, Chairman

Kristine L. Svinicki, Commissioner

George Apostolakis, Commissioner

William D. Magwood, IV, Commissioner

William C. Ostendorff, Commissioner

APPEARANCES

ACRS Members:

Said Abdel-Khalik
Chairman

William J. Shack

Dana A. Powers

Michael L. Corradini

Dennis C. Bley

NRC Staff:

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Director of Engineering, NRO

P R O C E E D I N G S

CHAIRMAN JACZKO: Well, we will now begin our meeting with the ACRS. We have a variety of different important issues to discuss and, as usual, I think there will be some very good presentations and likely some very good questions and comments from the Commissioners. So, with that, I'll turn it over to Dr. Abdel-Khalik to begin.

DR. ABDEL-KHALIK: Thank you. Good morning. Since our meeting with you in June, we have issued 15 reports. Please put the slides on, first slide. Next slide. Next slide. Thank you. Since our meeting with you in June -- thank you ma'am, okay -- we have issued 15 reports. You will hear more details about five of those reports in this meeting. Those reports pertain to DAC closure, 50.46(a), MOX Fuel Fabrication Facility, aircraft impact amendment to the certified APWR design, and long-term cooling for the ESBWR. Next slide.

We have also issued a report on the closure options for GSI-191. Our colleague, Sanjoy Banerjee presented the Committee's views on that subject at your September 29th meeting. Other topics covered in our letters include final SER associated with the ESBWR design certification application, SER with open items related to the South Texas Project COLA, referencing the certified APWR design, risk-informed regulatory guidance for new reactors, digital I&C interim staff guidance on licensing process, ISG-6.

We have also issued reports on the license renewal applications -- next slide -- we have also issued reports on the license renewal applications for

Cooper and Duane Arnold, reviewed two Reg Guides and the standard review plans for fuel cycle facility license applications. Next slide.

In the area of new plants, as I indicated earlier, we have completed our review of the final SER for the ESBWR design certification. We continue to review the proposed amendments to the AP1000 design certification, and the design certification applications and CR with open items for the USEPR and the USAPWR designs. We are also reviewing long-term cooling for the APWR and AP1000 and the reference COLAs for the various designs. Despite the heavy load, we continue to complete these reviews promptly as the information is made available to us. Next slide.

In the area of license renewal, as I indicated earlier, we have completed our reviews of the Cooper and Duane Arnold applications. We have also held subcommittee meetings to review the Kewaunee, Palo Verde, and Hope Creek. We expect to complete these reviews as well as those for Crystal River, Salem, Diablo Canyon, and Colombia in the next several months. Yesterday, we reviewed the proposed updates to the Generic Aging Lessons Learned Report, and we will shortly issue a report on this subject. Next slide.

In the area of power uprates, we expect a review of the EPU applications for Nine Mile Point and Point Beach within the next few months, along with the associated vendor topical reports supporting those applications. Next slide.

This is a partial list of what's on our plate: the expected staff's paper on containment accident pressure, SOARCA, safety culture, fire protection, digital I&C, 50.46(b), et cetera. The bottom line is that we are going on all cylinders. Nevertheless, I wish to emphasize that despite the heavy load we

continue to conduct each and every review with a deliberate sifting and winnowing which are the hallmarks of the Advisory Committee on Reactor Safeguards. Thank you.

At this point I'd like to move to the first item on the agenda, the next item, which is the ABWR Aircraft Impact Assessment next slide, please. Next slide. As you know, 10 CFR 50.150 requires new power plant applicants to perform an assessment of the impact of a large commercial aircraft. The assessment is not submitted to NRC but is subject to inspection by the staff. Next slide.

The assessment must show that with reduced use of operator action, the reactor core remains cooled or the containment remains intact and, spent fuel cooling, or spent fuel pool integrity is maintained. Next slide.

The certified ABWR design predates the Aircraft Impact Assessment rule. Hence, STP submitted an amendment to the certified design in order to address the requirements of 10 CFR 50.150. Future COL applicants can comply with the AIA rule by referencing the amended ABWR standard design.

Next slide. The important point I want to make in this presentation is that even though the applicants are not required to submit their assessment, a process has been developed to allow ACRS to perform a thorough, in depth evaluation of the analysis. The applicant has voluntarily made the assessment available to ACRS. By reviewing the detailed AIA itself, along with the associated safety evaluation and inspection reports, we were able to provide an informed opinion on the acceptability of the amendment. This review process has also been followed for the ESBWR design, and will be followed for the other

design centers. Next slide.

The conclusions and recommendations enumerated in our September 20, 2010, report on this matter state that staff inspection of the applicant's AIA was thorough. By using the same skilled personnel for both reviewing the application and performing the inspection, the quality of the reviews were significantly enhanced. The application and SER are acceptable subject to satisfactory closure of the issues identified in the notice of violation issued by the staff following the inspection and our recommendation -- next slide -- that the staff should insure that the applicant demonstrates that the temperature within the fire protected area where the alternate feedwater injection system instrument track is to be located, will not exceed the instruments' environmental qualification conditions. We also recommended that the staff should insure that the assumptions and initial conditions credited in the applicant's AIA are properly incorporated into the amended DCD. Next slide.

Additionally, the staff should insure that COL applicants referencing this amendment have an appropriate process to assure the reliability of the alternate feedwater injection system and that the staff should complete a “lessons learned” review to identify any deficiencies in the AIA inspection procedure and the methodology prescribed it NEI-0713. We have received the EDO response to our letter. The Committee will deliberate the acceptability of that response later today. Thank you. That concludes my part of the presentation.

At this time, we will move to the next item on the agenda: Risk Informed Changes to Loss of Coolant Accident Technical Requirements, 50.46(a) and Dr. Shack will lead us through that presentation. Thank you.

DR. SHACK: First slide, please. In March 2003 the Commission directed the staff to prepare a proposed rule with an alternative break size for LOCAs. The design basis accident approach developed in the '60s and '70s has been very successful in developing reactors with a high degree of safety. However, focusing on a very specific accident sequence can have unintended consequences affecting more likely sequences that could be detrimental to safety. Therefore, there is an interest in re-examining the requirements for the design basis rules. The staff prepared a rule and ACRS reviewed that rule in November of 2006 and our letter recommended that the 2006 version of the proposed rule not be issued. The Commission provided additional direction to the staff that addressed ACRS concerns and the staff developed a revised version of the rule. This version of the rule was discussed with the ACRS in May 2009, discussed with public stakeholders, and again with the ACRS in September and October of 2010. Next slide, please.

In the new rule there'll be a transition break size defined below this break size. It will be a design basis accident above this break size. It will be treated in a less rigorous manner. For PWRs, the transition break size is the cross sectional flow area of the largest pipe attached to the RCS main loop. For BWRs it is a cross sectional flow area of the feedwater or RHR pipe. Based on expert elicitation and other things, we can expect the frequencies of breaks greater than these sizes to be substantially less than 10 to the minus five per year.

For breaks less than this transition break size, there'll be no change from the current 50.46 analysis requirements. However, consistent with Commission direction, there will be a capability to maintain -- or a capability to

mitigate breaks greater than this transition break size up to the DEGB of the largest pipe will be retained, but the analysis requirements will be reduced. In particular, you won't have to -- will no longer have to assume a single failure in you safety systems, take credit for off-site power. Most importantly, perhaps you can take credit for non safety equipment that might be used to mitigate the accident, and may propose alternate metrics for coolable geometry if justified. Next slide, please.

Now again, for a plant that actually adopts this rule, it's a enabling rule that the plant can go off and make changes which are not terribly well defined by the rule. What the rule gives you is a process for making changes enabled by the rule. And again, these changes -- you must evaluate the risk impact of the changes and show that they meet the risk-informed acceptance criteria that are part of the rule. And again, there is a criteria for changes that have to be submitted for NRC review and even those changes are limited to a very small cumulative risk increase overall. And again, that's 10 to the minus six CDF and 10 to the minus seven LERF.

The licensee will also have an ability to make self-approved changes, but those will involve, again, minimal risk increases which again, the rule is interpreting as 10 to the minus seven CDF and 10 to the minus eight CDF, and you'll have to satisfy the other requirements of 50.59 that licensees generally do when they make changes without NRC approval. For all changes, the risk will be small: maintain defense and depth, consider safety margins and a monitoring program to assure that the assumptions that you're using are consistent.

Going back to the -- our ACRS letter on November 16, 2006 -- next slide, please -- on the revisions that we wanted to see in that version of the rule,

one of them was we felt that there was a need to strengthen the assurance of defense-in-depth for breaks beyond the transition break size. We were also concerned with the magnitude of the risk -- increases in risk that could occur to changes that did not require prior NRC approval, because we felt that the guidance was inconsistent with the usual Reg Guide 1174 for that kind of change. Next slide, please.

We also felt that since it was possible that this would lead to essentially power uprates and additional loadings of the core that we address the 50.46(b) guidance for cladding failure which again, some research evidence had shown was perhaps not completely accurate in its current form. We also felt there was a need to perform plant specific analyses to assure the applicability of the studies that the staff did. Again, the expert elicitation which were documented in NUREG-1829 and the studies they did on seismically induced failures which were documented in NUREG-1903 to assure ourselves that the transition break size did in fact have failure frequencies as low as we expected, less than 10 to the minus 5 per year.

If we examine the draft final rule that we received in September and October, we think that they've resolved most of these comments. It requires licensees to submit the codes used for the analysis of breaks beyond the TBS to the NRC for review and approval, so we have a high degree of confidence that we're analyzing these things adequately. The process for changes that can now be made without prior NRC approval has been revised and is now acceptable and consistent with what we would expect to do with 1174. Next slide, please.

The rule still reflects the current 50.46(b) cladding failure criteria. However, we have performed additional research. I think the staff has a good

understanding now of different mechanisms that can affect cladding failure. A notice of advance rulemaking has been published, and the staff acknowledges that the 50.46(a) rule will have to be revised when and if the 50.46(b) is updated. We now find it acceptable to proceed with the 50.46(a) since the 50.46(b) revision is well under way. Next slide, please.

Most importantly, we've got our requirements that there is a plant specific demonstration, that the results of the NUREGs on the elicitation and the seismic effects for transition break size are applicable on a plant-specific basis. We reviewed a version of the rule that the staff proposed in August that required a demonstration only that the results on direct pipe breaks were applicable. We didn't see any reason to distinguish between pipe breaks -- direct pipe breaks, and indirect pipe breaks due to support failure and so we wanted to essentially also require -- have the rule also require -- that indirect pipe failures would be analyzed and assured to be consistent with the understanding that they were less than 10 to the minus 5th. And in response to the ACRS comments the September 27 version of the rule was revised to require a demonstration of the results that indirect break sizes are applicable. So we're comfortable with that. So, next slide.

With these changes we find that the draft rule 50.46(a) an acceptable risk alternative, informed alternative to the current 10 CFR 50.46(a) for operating reactors. We do have some questions about the rule, and that's its application to new reactors. The current version of rule, of the draft proposed rule, is presumed to be applicable to new reactors. For the new reactors, the transition break size will be determined on a plant-specific basis, or at least a design-specific basis. And the ACRS certainly agrees that with improved

materials, water chemistry and design practices we're going to further reduce the likelihood of large LOCAs in the new plants. However, we feel it's premature to extend the proposed 10 CFR 50.46(a) to new reactors at this time. The risk profiles for these plants are significantly different from current reactors; they're typically considerably lower. We're still discussing what appropriate risk metrics and risk acceptance criteria should be applied to these new reactors and that's still under development. Next slide.

The current version of the rule, the staff has adopted the language they proposed in the recent SECY they sent up to you on risk metrics that essentially says that risk-informed changes should not result in a significant decrease in the level of safety otherwise provided by the certified design. And we have sent up a letter essentially agreeing with that approach and recommending approval of that Option 2, but again, even if it's approved, that SECY is approved by the Commission, we still have to develop specific guidance. It's sort of a concept; it's not really specific guidance. We feel that rules should be based on specific guidance rather than on a concept that's not yet clearly defined.

However -- next slide, please -- since our advice is not always accepted, we did include one proviso that if new reactors are included in the scope of the rule, then the requirement that the adoption should not result in a significant decrease in the level of safety should apply to all risk-informed elements, including the determination of an allowable time without capability to mitigate beyond design basis transition break size LOCA. And that completes what I wanted to say about 50.46(a).

DR. ABDEL-KHALIK: Thank you, Bill. The next presentation deals

with MOX Fuel Fabrication Facility and Dr. Powers will lead us in that.

DR. POWERS: Most of the time we come to the Committee talking about reactors, power reactor issues. Today I'm going to talk about something decidedly different: It's the MOX Fuel Fabrication Facility. I think you're aware that this fuel fabrication facility is being developed for the Department of Energy by MOX Fuel Services at the Savannah River site. The purpose of the facility is to convert weapons grade plutonium into mixed oxide fuel. The facility involves the purification of the plutonium dioxide and fuel fabrication.

A process that's being used is patterned after one that's been successfully operating in France for the fabrication of mixed oxide fuel from radioactive grade plutonium. It does build on a very substantial body of experience in the United States with the Purex process for solvent extraction of plutonium in the purification process. However, the MOX Fuel Fabrication Facility is much simpler than the reprocessing of spent nuclear fuel. You do not have to deal with a large inventory of either fission products or activation products. The facility is even further simplified because the waste handling is done, not at the facility but in fact it's transmitted to the Department of Energy for their final disposition.

The review process for this facility is a two-step process. It involves a construction authorization request and then a license to possess and use special nuclear materials. And on the next slides I want to just comment that we have issued to you previously a report on the construction authorization request. In that report to you we did highlight the need for the licensee to address a variety of safety issues, the process issues like hydroxylamine nitrate, the infamous “red oil”, facility issues such as glove box fires and criticality issues.

Next slide.

They have submitted their final application for a license to possess nuclear material. We have reviewed that application. The application is very good. It has addressed most of our issues. The facility provides adequate shielding infiltration to protect the public. To address the process issues, they have adopted best practices and best analyses. In the area of the red oil phenomenon they've adopted an administrative approach to that, one that's been advocated by the Defense Nuclear Facilities Safety Board for DOE facilities. And indeed they've gone quite a bit beyond that because it's a new facility; they can do things that you can't retro fit into other facilities.

The staff has prepared a safety evaluation of this facility, and it is quite a detailed safety evaluation. These facilities are complicated and involve lots of tedious processes involved in the -- for the material accountability issues. And so there's lots and lots of systems in these facilities. Staff has done quite a good job of going through that application in a fairly systematic fashion. Based on that review, we conclude the proposed facility can be constructed, operated and maintained with no undue risk to the public health and safety.

The licensing process is a bit more complicated in that they do have to verify the construction of this facility before the license is granted. We propose that we will revisit the MOX facility as that construction process gets closer to completion, and probably issue you a final report on it at that time.

DR. ABDEL KHALIK: Thank you, Dr. Powers. The next presentation deals with the ESBWR Long-Term Core Cooling, and Dr. Corradini will make this presentation.

DR. CORRADINI: Thank you. Good morning. So I'm back with

ESBWR. It's been my assignment since I've been here, so I'll lead you through this one particular portion of it. On May 8th of 2008 the Commission requested the ACRS to advise the staff and Commission on the adequacy of the design basis long term cooling approach for each new reactor design. And in that, we were to choose either its review during design certification or the first license application referencing that design. Since the ESBWR was docketed back in 2005 and we began looking at it in 2000 late '06 and early '07, we chose to look at the DCD to specifically answer this question. Next slide, please.

Just to remind you, I'm sure you're all familiar with the design but just in case, the ESBWR is an advanced light water reactor design that uses a direct cycle power conversion system driven by natural circulation in the reactor vessel. This is relatively unique compared to current BWRs which have poor circulation. Next slide, please.

And to continue, it has a passive ECCS, which is designed to perform its function without the need of emergency AC power systems during the first three days for core cooling following any sort of reactor transient or accident. In doing that, it employs isolation condensers as well as a passive containment cooling system which I'll have a cartoon of in a bit, or PCCS to transport heat to the ultimate heat sync for all accident scenarios. Again, this is relatively unique, and I'll try to explain it or at least remind you of it. Next slide, please.

So the ESBWR design has a long term cooling mode that is qualitatively different from current reactors since its passive safety systems can respond to a design basis accident, and specifically, without recirculation through the suppression pool where debris may hide out.

So I have a conceptual picture on the next slide. Good. So, I don't

have my laser pointer, and I can't stand up due to protocol so I will point you to the upper left-hand part of the cartoon. And if we were have some sort of accident like a limiting accident for the main steam line break, what you expect to see then is steam or some sort of two phased mixture coming out of the main steam line issuing into the dry well. And the path for long-term cooling after all the transient processes in the first 10, 15 hours, okay, is that what you have is this mixture of wet steam coming into the PCCS pool, all right, PCCS condensers and then the condensation divides the flow into, essentially, condensates what goes back to the GDCS pool and then flows back into the vessel. And that's your essentially circulation path for providing water to the system over long term. And any remaining steam or non-condensables flows down into the suppression pool and bubbles up. So that's quite unique. And I want to make sure we at least have that in mind as we proceed. Next slide, please.

So, the generic issues that have normally been raised for long term cooling in a recirculation mode for the ECCS are really not present in this design for these following reasons: First -- next slide, please -- the fibrous insulation used, and this is similar to all advanced plants; I don't want to give you the impression this is different. All the advanced plants, no fibrous insulation is used in the plant design. All containment surface coatings are qualified and no complex water chemistry is present. Next slide, please.

And for the DBA response, the debris, as I discussed with you, which reaches the suppression pool and would then lie there, is not transmitted to the PCCS. The recirculation cooling path, as I pointed out before for long-term core cooling is this wet steam which enters into the PCCS. That condenser, essentially then the flow is split. Condensate goes to the gravity driven cooling

system, or GDCS, flows back to the vessel and that's your closed path which provides long term cooling and no uncovering of the core.

So with that, the ACRS in its letter concurs with the staff's assessment that the regulatory requirements for long term core cooling for design basis conditions have been adequately met and this issue can be closed for the ESBWR. Thank you.

DR. ABDEL KHALIK: Thank you, Mike. The final topic to be presented is Closure of Design Acceptance Criteria for New Reactors, and Dr. Bley will lead us through that discussion.

DR. BLEY: Thank you. I'm going to start at the end and then work backwards to set the stage for this, and the end for us was the ACRS letter report of August 9 of this year. We had two recommendations in that report: First, that DAC closure requires expertise, judgment, and interpretation. It should be performed by NRC staff experts with an independent assessment by ACRS; and two, it's preferable that all DAC be resolved no later than the COL stage. However, whether resolved as part of the COL process or post COL, proper closure of DAC requires a consistent scope and depth of evaluation in accordance with the first recommendation.

Much of that letter report dealt with the history of Part 52 and the ideas that underpin it and we needed to do that for ourselves. There's only a couple of us who go back very far in this, in our tenure on ACRS. Next slide, on background.

We'll start even before that and the statements of consideration for 10 CFR Part 52 do state that early site permit design certification and COL processes do not eliminate any material safety issue from consideration. They

just move the resolutions earlier in the review stages. In essence, the NRC cannot allow operation of a nuclear power reactor unless, of course, all material safety issues are resolved. Next slide.

The statements of consideration go on, and I'm going to read this quote: "The Commission does not believe that it is prudent to decide now before the Commission has even once gone through the process of judging whether a plant built under the combined license is ready to operate, that every finding the Commission will have to make at that point will be a cut and dry proceeding according to a highly detailed objective criteria entailing little judgment and discretion in their application and not involving questions of credibility, conflicts and sufficiency." Next slide.

Part 52 requires conformance with certified design verified through inspection, tests, analyses and acceptance criteria, the ITAAC. Practicalities, in particular, less than complete design submissions, led the staff to develop the concept of a special kind of ITAAC called DAC, design acceptance criteria. The DAC permit certification by replacing elements in the design with acceptance criteria that could be confirmed later. In one sense, the introduction of DAC under Part 52 effectively shifts some of the uncertainty to later in the regulatory process. The DAC as presently constituted seems to us as clearly among those issues for which judgment will be required in order to reach a finding that the acceptance criteria have been satisfied. Next slide.

The next piece in this story began with the SRM on SECY-93-077, which was titled Requirements for Design Certification under Part 52. And this is a precursor to DAC and really tells where Part 52 began. It required applications for design certification to reflect a design that is complete except to

accommodate as procured hardware characteristics. Our report on that SECY agreed with the process and recommended that the staff focus on the scope on that needed to safety. If you go back and look at that SECY, the scope seemed very, very broad and we were trying to bring it back a bit. Next slide.

The concept of DAC was actually introduced in SECY-92-053 , although there was a Commission meeting some time before that where the concept was discussed. This was the first time it was enumerated and really all laid out. And basically, what's happening as we get to that point is the expectations of complete design that were in SECY-93-077 started to run into some trouble. This SECY identified the need for DAC and that vendors were not providing detailed design information in several key areas. One was areas of rapidly changing technology where it was felt you didn't want to freeze designs early on, and the other were areas where as built or as procured information wasn't actually available at that point in time. The SECY went on to identify pretty much all the potential pitfalls that people have worried about since that time. It was very thorough in that way. Next slide.

92-053 defined DAC as a set of prescribed limits, parameters, procedures and attributes in a limited number of areas. DAC were to be objective and by that it talked about being measurable, testable or subject to analysis using pre-approved methods, and were to be sufficiently detailed to provide an adequate basis for the staff to make a final safety determination regarding the design. And I guess here I just recall that admonition and then, in the statements of consideration that before we've actually done this once, maybe it's hard to be as completely objective as we'd like. Next slide.

Finally, SECY-92-053 recognized that although there was nothing

in Part 52 that would necessarily limit the use of DAC, the staff believed that the use should be limited and that restrictions should be based upon a consideration of those design areas affected by rapidly changing technologies. Next slide.

ACRS wrote a report in February of '92 on this concept and supported the limited use of DAC. But pressed to say carefully defined limits relating to scope and extent of design coverage should be placed on that use, and that it should be limited to that portion of each given design feature where either the technology is still evolving or the required information is unavailable for good reason. Next slide.

Our report went on to say that in any case, DAC should be used only when it's possible to specify practical and technically unambiguous criteria. And it's fair to say we worried that DAC can hide unforeseen systems interactions that might be uncovered if an actual design were available. And, in fairness, SECY-92-053 also recognized that same possibility. Next slide.

Finally, in our '92 report we said if DAC were employed extensively in lieu of design detail this would place an additional design burden on the combined operating license holder and create a possible discontinuity in the design and review process that could be averse to safety. Later in that same year, ACRS formed an ad hoc subcommittee on DAC and had quite a few meetings with staff and with the vendors and the vendor in particular was GE with the ABWR. Reading the record of those meetings, it appears that staff and the ACRS came to fairly quick agreement on the DAC issues related to radiation protection, piping design and control room design, which now is part of the human factors engineering criteria for ABWR DAC. I&C DAC were more troublesome and at least in those meetings I don't think you can find a record of it

being completely resolved. Next slide.

One of our reports based on the work of that ad hoc subcommittee had several conclusions that we want to put forward again. Finally, we are concerned about the significant number of post design certification activities associated with these two DAC: Control room design and I&C. The COL applicant or holder will be responsible for carrying out these activities. This will involve extensive future negotiations with the staff. It will also have the effect of diminishing the value of certified designs and seems to us to be contrary to the spirit of Part 52. We went on to say that we believe that the arguments that these DAC represent areas of rapidly changing technology is being overplayed by both the staff and GE in justifying the extent to which the DAC process is being used. And, of course, this still remains a concern for us. Next slide, please.

Over the years, and this isn't exactly documented anywhere but we've talked about it quite a bit as a committee, the ACRS had developed some expectations with respect to DAC that convinced us it was a reasonable way to proceed. First, DAC would be limited to the extent possible and generally closed by the time of COL issuance. Over the past three years, during our design certification subcommittee meetings, and later the COL subcommittee meetings, it became clear that maybe this wouldn't progress quite the way we expected. The second one was for DAC to be closed after COL and before a fuel load. Staff evaluation of ITAAC used to close DAC would be thorough. Also, over the last few years in our interactions, it became clear I think that there wasn't a consistent understanding across the people we talked with of how exactly this would proceed. Would it be very simple inspections by field inspectors? Would it

be detailed reviews, sort of like you get with the design certification or somewhere in between?

The third one is that ACRS would be involved in staff evaluation of DAC closure, at least for the first applications. And again, in our discussions people ranged from once the COL is over you are out of it to, of course, you know, you need to be involved all the way through. So, these expectations set us up and as we began to wonder if they were going to be fulfilled, led us over the last couple years to write several letters, first saying that the DAC closure process should be developed more clearly in the guidance and then to this last letter.

Let's go on to the next slide, and we're going to look at some observations of the Committee on DAC, and I guess I'd say forgive me if some of these sound like totalities, but I think over the years that hasn't been true. It's gradually maybe reached that point for some of them. First, digital I&C systems for some new designs are highly integrated and pervasive, affecting nearly all plant equipment. And I'm not sure that people imagined that 20 years ago. Maybe some did, but others I'm sure didn't. Unanticipated failure modes could create confusing situations for operators that could place the plant in odd configurations or lead operators to place the plant in unexpected or unanalyzed configurations. And there's some work that has been done by Research through researchers at Brookhaven that's actually taken a good look at what some of those things might be.

Next slide. We've organized things that are kind of broadly known under some kind of concise concepts, and they are that there are really five keys to reliability of digital I&C systems. Four of those are essential objective design

principles of redundancy, independence, determinate data processing and communication and defense-in-depth and diversity. And there is one subjective attribute, simplicity, that if we meet that it makes it much easier to understand all the others. And if we clearly show how these are met in DCDs, it could, we think, reduce the number of DAC that are required. We think it's possible to functionally specify digital I&C design and be able to show that it can meet those essential criteria I just talked about regardless of the parts technology, the specific implementation of the design and hardware and software. Next slide, please.

Some essential design principles can be specified in the DCD, as I was just saying, and then verified by objective ITAAC rather than design acceptance criteria. Others of those are a little more complex, for example, determinate data processing, and would need to be confirmed as implemented in the final design through a review process under DAC. Next slide, please.

Despite the ability to eliminate many digital and I&C DAC from design certifications and COL applications most are not planned to be resolved until after COL issuance. Most of the COLs we've been looking at don't address the DAC at all and pass them through to post COL review. Next slide.

Some of the current digital I&C DAC, if you read them carefully, are not technically unambiguous. Also, many DAC are process oriented, but only an evaluation of that detailed complete design can reveal the intricacies and possible interactions and failures, especially those of common cause and other dependant failure mechanisms. And that's just saying that you couldn't quite clear those with simple inspections. Next slide, please.

This is a bit of a reprise, back to our two recommendations in our

August 9 report. With our COL reviews nearing completion, we wanted to get these things on the record, that DAC closure requires judgment and examination by experts to ensure that they're met. And that we would really like to see all DAC completed before COL, but if not, they need the same kind of examination to ensure that the implementation of the design meets the specifications of the design that were existing at the time of certification.

There's another issue that we've struggled with, we didn't put it in our letter, but we've talked about quite a bit. And there are many who claim that this isn't -- that putting off the DAC until after COL is, in a sense, puts all the risk on the licensee, the holder of the COL, that risk of not being approved when the DAC are attempted to be cleared. There's a counter claim that people have talked about that the risk really falls on the NRC because after that point the burden of proof shifts to the NRC. And it's possible here that if there's disagreement here, we could have a shift from a technical review of safety issues to a legal evaluation of the rule. We're beginning to see stories put together on how the case for incomplete DAC could be, could be built very solidly. Let's go on to the next slide.

Just last month, as Dr. Corradini was telling us, we had a letter on ESBWR. And in that letter, there were two things relevant to this discussion. It pointed out that if an applicant provides -- I'm sorry -- additional descriptive information such as integrated system logic diagrams and detailed functional descriptions, the reviews would be simpler and the safety judgments would be more robust. It also pointed out that lack of sufficient ESBWR DNIC design information through these discussions led to a commitment to revise the DCD with sufficient expanded functional descriptions and additional DAC and ITAAC

to support the safety finding on the design specification. Next slide. Last slide.

Where do we go from here? Well, I've mentioned that several of our subcommittees are struggling with this concept and we just looked at ESBWR. We are also following the work of the staff's task working group on DAC closure that began about a year ago and we're watching that closely. And we've had some informal discussions, and we had a subcommittee meeting on this issue two weeks ago where staff presented examples and discussed the state of plans for future DAC closure. The full committee has not yet had a chance to deliberate on the information we gathered at the subcommittee. And we've also received a letter from EDO, the response on our letter of August and again, we're going to be deliberating on that later today. So we haven't together put together a committee position on where those things are headed, but we're watching it very closely. And that's the end of this discussion on DAC.

DR. ABDEL-KHALIK: Thank you, Dr. Bley. This concludes our presentations.

CHAIRMAN JACZKO: Well, thank you very much. We will turn to Commissioner Ostendorff to begin.

COMMISSIONER OSTENDORFF: Thank you, Mr. Chairman. Before I start with some questions I want to thank Said, you and your leadership and all your ACRS members. You all do indeed have a very heavy workload and I've been impressed with the professionalism with which every one of your members have approached their task, and we're all grateful for that.

DR. ABDEL-KHALIK: Thank you, sir.

COMMISSIONER OSTENDORFF: I want to start off with Dr. Shack, if I can, and 50.46(a). I just want to ask one question looking at your

Slide 29. In the middle of the page you note that with respect to application of 50.46(a) to new reactors -- I'll let you get to Slide 29 -- I wanted to maybe get a little more granularity as to the notion there that even if approved by the Commission that specific guidance would need to be developed. Could you talk maybe a little bit about that specific guidance or some attributes of that guidance?

DR. SHACK: Well, you know, Option 2 for the risk metrics paper essentially makes the statement that you're not going to -- that the changes shouldn't result in a significant decrease in the level of safety otherwise provided by the certified design. But I don't think anybody means that there can be no decrease in safety, no change in safety, whether it's relative to the safety goal, relative to the internal events safety, relative to the total safety including seismic, which we don't know for plants yet. So there are a lot of concepts I think that need to be worked out there, whether just how this will be implemented. And so to our mind this is a concept yet. It's not really guidance. It's not really a development of the risk metrics that are applicable to the new reactor, and so it is inappropriate language for a rule where we're at.

COMMISSIONER OSTENDORFF: Okay. Does anyone else want to add to that? Okay, thank you.

Dr. Bley, I'd like to turn to the DAC process and the focus of my question is just on the digital I&C portion of that. I know that a lot of these documents and policies go back to the 1990 and 1992 time period, so this is not a new issue. And I'm certainly no expert on digital I&C, but I've used a lot of digital equipment in the military and in the context of navigation weapons systems, et cetera, on submarines, missiles, torpedoes, sonar fire control. I'm

trying to understand, when one looks a different technology publications or kind of assessing where science is, and I'm going back to the notion of rapidly changing technologies, with respect to digital I&C, is there a view that that is still a rapidly developing area or has it kind of leveled off? Is it more stable as far as the technologies that vendors and licensees are looking at. I'm trying to see what the derivative is on that line. Is it still changing so fast that you can't predict where we will be in two years from now or four years from now? Could you talk about that aspect?

DR. BLEY: Just a little. I'd say we haven't come to the point of having worked out a committee position on this but a number of the people who are more involved in that area think two things about that. One is, as we get close to the issuing of licenses in the building of plants, the situation has probably stabled off to some point. But there will still be some competition in implementation. But properly defining the architecture and the requirements in that specification stage can lead to a place that what you have to ensure in the implemented design will be an easier process to do than it would have been if those weren't well defined in the DCDs. But I think a general feeling is that there could certainly be more detailed information included in the DCDs than has typically been included. In some of the ones now we're getting a little more of that into it.

COMMISSIONER OSTENDORFF: Okay. Can you give us some sense as to how other countries that are licensing nuclear reactor plants for commercial use, how they're dealing with these issues?

DR. BLEY: We've only looked a little at that. And I think some of the issues that have been raised in other countries have as much to do with how

they define things like what is safety equipment as with the detailed technical issues involved. So I know in some countries there have been objections and requests for design changes to firm up things like diversity in design, but I don't have a complete survey on that. Although, we attended the quadripartite meeting two years ago, and I don't know if more information came out of that. Mr. Brown was our representative. Is there anything more to say?

MR. BROWN: It's a mixed bag. The Germans haven't done much. The French

DR. BLEY: If you're going to speak, you have to come up to the mike. I was sure if you were going to talk or not.

MR. BROWN: You asked me. When we attended that meeting there were four participants: The Japanese, the Germans, the French and the United States. We presented the information relative to what Dr. Bley talked about in terms of being able to separate technology from the level of design. We made three presentations relative to what's being done here as well as kind of a theoretical application of microprocessor or computer based systems to digital I&C.

The Germans didn't -- Dana, correct me if I'm wrong -- didn't seem to have, they've not made much progress. They're not really working on it all that hard. The French are doing they're going after it. They've got their designs. And the British were not in attendance but if you read the other information we've gotten they're now addressing the same things we're addressing in terms of some of the applications that people are proposing for their designs. The Japanese have already installed some. In the plant we looked at, I believe that my memory is, this is a year ago -- that it is not exactly all computer-based or

what I call software-based. It's a field programmable data array logic which is fundamentally hard wired digital logic, not software based digital logic which is considerably different. And that is it similar to some proposals we have on the table today for the certifications that we're looking at now. So there's two differential -- two different types of technology to look at. That's an answer. If you want any more on the technology issue, I would elaborate on that if you want me to.

COMMISSIONER OSTENDORFF: Let me ask one other question while you're at the podium, if I can. I have to comment, I haven't seen him since 1992 --

[laughter]

-- when I was going through PCO training with [inaudible] over there, so it's good to see you again.

MR. BROWN: A little history. Thank you, sir.

COMMISSIONER OSTENDORFF: Let me shift maybe industries here just for a moment while you're at the podium. FAA high technology, high consequence of an error within commercial aircraft, there's other applications I'm sure that deal with high consequence i.e. the potential death or injury if there's a problem. Any sense as to how FAA or other high consequence technologies are being evaluated by other federal agencies in these areas?

MR. BROWN: I cannot answer that question authoritatively. We did do a study or not we, the staff did a study, contracted for a study which looked at the application of software based systems across a number: Railroad, airplanes, industrial plants, and found a very wide variety of applications. It was primarily focused on diversity and defense-in-depth and how was that attacked.

So, but different technologies were used across the board and how they evaluated it were different from industry to industry.

DR. BLEY: I can offer a couple things. I'm on the National Academy Committee that's looking at this sudden acceleration issue for automobiles. And we're trying to dig into other industries and see what people are doing. We haven't gathered much information yet from the airline industries. Through a colleague I saw some presentations and actually there was a presentation made to NRC staff a couple years ago that looked at a number of space related incidents. And the interesting thing that's very different from the automobile case is that for NASA, they have so much telemetry that following -- I'm trying to remember numbers -- it was something like eight or 10 very serious accidents, they were able through the results of the telemetry to identify exactly what went wrong and it was tied at least six of eight cases, something like that, six of 10. It was completely tied to digital I&C and to various problems from improper input into a program to some interactions among the computing devices that weren't expected. So they were seeing more than half of the serious incidents they were looking at linked to problems in software.

The automobile issue is not at all resolved, and we're still looking hard at that. The problem there is there isn't much of a record of what happened. Some automobiles have black boxes, but they don't keep much information, and very few cases following one of these problems that could be associated with the electronics has it been possible to actually tie it clearly through evidence of the electronics. They're looking for ways to better understand. There are things that are either intermittent problems in those systems or somehow human-related problems and nobody knows for sure. So it's not completely clear everywhere.

The airline industry might be useful, but I don't know much information about that yet.

COMMISSIONER OSTENDORFF: That's very helpful. Thank you both. Thank you, Mr. Chairman.

COMMISSIONER SVINICKI: I lost my train of thought a little bit, Dr. Bley, when you mentioned automobiles having black boxes. That sounds a little Big Brother. My first thought was, does mine have that?

[laughter]

-- monitoring that...Okay. Anyway, to go back to my actual train of thought was, I wanted to thank you all for your presentations and your work, as the Chairman said about an hour ago. It's a very distinguished group. And I always appreciate the opportunity to sit with the members of the Committee and to be brought up to date on the Committee's tremendous efforts since the period we last met.

I will just say, also, that I continue to hear from the NRC staff that the Committee and all the subcommittees have been very uniformly accommodating of as schedules and other things need to be adjusted, and I continue -- I'd like to express my gratitude for that because I know the Committee is very busy and the members have other demands on their time. The staff is not always able to perfectly sequence its work so I want to express my gratitude for the Committee and subcommittee's willingness to make adjustments. And I know we can't -- we cannot rely upon that endlessly so I also know that there are limits and you do the best you can. So I just wanted to start out by expressing my appreciation for that.

Dr. Powers, I wanted to ask you about your presentation on the

MOX facility. I appreciated that update, but when I had read the Committee's report and also in your presentation on the path forward. Well, first of all you acknowledge that this is different, obviously, than the Part 52 process so this is a two-step process. But you indicated the likelihood that the ACRS would revisit the safety evaluation of the MOX facility as construction approaches completion. And that seems to me to be a bit of a unique step here. Can you help me understand what you would be looking to re-verify at that point?

DR. POWERS: We were just simply looking to see that indeed the construction patterned after what was in the application that, quite frankly, we're just reserving a place holder there. We don't anticipate any difficulty, but since the construction is roughly 70 percent done, as it goes forward, will it indeed comply with the plans laid out for us on paper? That's the only thing we're looking for there.

COMMISSIONER SVINICKI: Okay. Is it fair to say that again, you've indicated now that you're kind of reserving it so it isn't necessarily a definite plan? I guess it would depend on the circumstance you found yourself in at that time. But is it fair to say that it also has to do with the uniqueness of this MOX facility? It's not as if this Committee has taken a view that it is necessary for a lot of the construction in every area for the Committee to go back? Okay.

DR. POWERS: It's quite a fair interpretation. We're just a little cautious here, that's all.

COMMISSIONER SVINICKI: Okay. Thank you for that.

DR. POWERS: Nothing was flagged. In fact, quite the opposite. The application was very well put together and was very thorough. Very good review by the staff as well.

COMMISSIONER SVINICKI: Okay, thank you for that. And I guess that foreshadows a little bit, I'd like to discuss the DAC area a little bit. Since my first Commission meeting with the ACRS when it became apparent to me that there was a lot of energy around the issue of DAC and also maybe some persistent and growing heartburn, I'll call it, or concern about DAC, I tried to go back. I reviewed some of the '92 papers. I asked for an NRC staff briefing on it. And it's interesting, as I've watched this evolve. I think the discussion today is very timely. Dr. Bley, I appreciate that you stepped really all the way back at the beginning, even though you started with the August letter, but I think that's very helpful that you went through that process. But I'd like to ask some really basic questions to be certain that I'm calibrated on the Committee's positions and concerns on this issue.

So I would start with a question that the Committee has expressed in its letter that a closure of DAC will require the exercising of judgment, and there seems to be a very precise choice of words there. Could you help me understand? I look at often the NRC staff will have to exercise judgment. Is the Committee's emphasis on that have to do with the degree of expert judgment that needs to be exercised here, that it is beyond what the staff typically has to do in what I'll call -- I'm going to use this term implementation phase, because at its heart I think what I'm struggling with is the ACRS's apparent desire to be involved in later stages of the closure of the ITAAC related to DAC. And I want to speak somewhat plainly about that because I think it's unusual to put the ACRS into a kind of a later implementation stage of an NRC staff process. And so I'm very open, but I'm trying to understand at heart how the Committee -- the other thing I need to mention is, you acknowledged at the end of your presentation the

Committee still needs to deliberate the staff's most recent transmittal to you, about this. But has the Committee struggled with this notion of putting the ACRS in a place where we don't typically find them in the ITAAC process? And how have you all discussed that and struggled with that?

DR. BLEY: That's a very broad question, so there are a lot of things to touch on. Let me do it in pieces. And even though we haven't discussed the letter, one of the points staff made in the response to our letter was that they try to -- they drew an analogy between the traditional ACRS involvement in the inspection process pre startup, after an operating license is issued to this situation. There are different characters. The analogy seems a bit overdrawn, I think. When you get the operating license under Part 50, you've had a complete design, staff has done its thorough review and ACRS was involved in the review all the way through. Therefore, what the inspections pre startup are about is just making sure the pieces that get put in are what the design document said they were.

In the current case, we have a design specification. Those of us who do reliability work and have worked in plants know that meeting the specification often you can do many different ways and some of those ways generate problems that you don't see until you look in detail. The idea of having judgment and expertise in that closure of DAC isn't anything more than the kind of judgment you would have during design certification review. It's precisely that kind, though, and there were hints from some people along the way that this would be more like a startup inspection with a field inspector saying that's the right box. Yes, the report is there. But if it's a report on -- the one we cited was a single failure analysis -- that's a kind of open ended analysis and it requires

somebody who understands that kind of analysis to look at the report, see if it was thorough, see if it looked at the right things and raised the right questions. That's the kind of judgment. And those things can actually occur in the implementation, even though the design specifications don't have any of those in the analysis.

So it's that looking at the final piece to make sure it meets the specifications in all ways. And when you do these various analyses required by the IEEE standards, they're the kind of analyses that have been done always in reviews of systems. It's at that stage where you find things that sort of meet all the rules, meet all of the specifications, but they're hooked up in a way that can cause problems.

I could give you some simple examples that have nothing to do with digital I&C. In the power plant where we're doing a PRA you had three diesel generators that had to meet single failure criteria. It did, but the way it did it was to have no single failure could fail all three diesels but in fact there was a failure that could fail two when it didn't need to be that way. Two of them got their diesel oil supplied via the same pump. So it meets all the rules but the reliability of the overall system was much lower than it ought to be.

There are many more examples like that but our concern is, as you go from specification to implementation, we've always done our reviews under Part 50 with the implementation and there are possible problems that occur there and we thought the folks who look at that stage need to have the expertise to do that kind of a look. And since it's important to do that thoroughly, the kind of reviews ACRS does and the questions and the examination that is being carried out in a thorough way, asking all the right questions

COMMISSIONER SVINICKI: Okay --

DR. BLEY: there's a reason why we thought we should be involved. I'd say I don't think we struggled to hard about whether we should be involved. We struggle about, could we be involved? But I think the Committee is pretty close to unanimous that looking at that process is important.

COMMISSIONER SVINICKI: Okay, and just to be sure that, because what I take from that answer and decide -- and I'll let you just weigh in quickly in a moment -- but what I take from that is that you're saying that DAC for say piping is more amenable or akin to this kind of field inspection. And for digital I&C, the Committee is saying what is really going to occur for ITAAC closure that have DAC for digital I&C, what the NRC staff will be doing there is more akin to the kind of design cert review that the ACRS is involving itself in now. Because you see it as so akin, it's just happening at a different time. You felt strongly about the value that you could bring to that. Is that just kind of a shorter way --

DR. BLEY: Not just that it's akin, but that it needs to be. And our reviews at that level have been useful in the past, we believe, very strongly.

COMMISSIONER SVINICKI: And I know you'll have a further report coming to the Commission so this is I appreciate you leaning forward a little bit.

DR. ABDEL-KHALIK: If I may add a comment, I think we've said many times in the past that the primary contribution that ACRS provides derives from the nature of its reviews. They are holistic, they're integrated, and we believe that that's where we would add value at that stage.

COMMISSIONER SVINICKI: Okay, that's very helpful and thank

you, Mr. Chairman. I'm over my time.

COMMISSIONER APOSTOLAKIS: Thank you, Mr. Chairman. I've noticed that in 50.46(a) and GSI-091, maybe Dr. Banerjee wants to jump in here, there is a lot of discussion and scrutiny on what we will do as an agency for breaks above the DBS, and nothing on what happens below DBS. Almost in passing, the documents say 50.46(a) will apply. Now it seems to me -- well, first of all I remind everyone here that there was a time when we used the expression "realistically conservative" and some people thought it was "conservatively realistic". It doesn't really matter.

So I'm wondering how realistically conservative we are if we just say apply 50.46 to breaks below the DBS? And how realistic we are, if we ignore the wealth of knowledge that we have accumulated in the last 30, 40 years regarding those small breaks, medium and small breaks? We have seen operators do great innovative things. The use of the fire water at Brown Ferry comes to mind. We have seen operators do detrimental things like turning off the high pressure injection at Three Mile Island. Below the DBS, we're silent. We don't attach operator actions.

Experience shows that single failures rarely lead to a problem, it's always multiple failures, and yet we are willing to go with single failures. And there have been numerous PRAs, both in this country and around the world modeling the sequence of events and that we expect to see in small LOCAs and medium LOCAs. A few days ago I was told that for a small LOCA, we may even never get to recirculation which is a problem in GSI-191. Isn't it time that we applied our questioning attitude to those breaks and see whether what we're doing is indeed realistically conservative and that we're using, you know, our

experience and the information we have collected over the years rather than saying 50.46 is good enough? Maybe Dr. Shack or Dr. Banerjee can start by telling us what they think about it?

One other thing is, of course, for some people, especially decision makers, the thought of bringing human actions into something is horror because they think that these are extremely uncertain. We don't know what to do and all that. The Office of Research has spent considerable resources the last 20 years trying to put some order in there, and again, we're completely ignoring that. Let the researchers do their research. We are real decision makers; we know what we're doing. So, any comments?

DR. SHACK: Well, clearly, Commissioner, that's not a topic that's addressed by the ACRS letter on the large breaks.

[laughter]

COMMISSIONER APOSTOLAKIS: That's what makes this meeting interesting, Dr. Shack.

[laughter]

DR. SHACK: I can obviously give you only a personal reaction and, you know, I think that's something that perhaps we can learn here, that since the immediate practical issue seems to be with the large break LOCA, if we went through a 50.46(a) type exercise, we would learn how to consider these mitigated actions that involve perhaps use of non-safety equipment, perhaps involve operator actions to manage water supplies. And when we gain some experience in how to do that -- I find it very difficult to risk inform pieces of regulation. What I like about 50.46(a) is it essentially opens the door for you to consider risk-informed changes, but it doesn't really make any real change

except to say, okay, you're now free to look at this in a risk-informed way, but you have to do a risk-informed analysis that considers everything that might be affected by any change that you make. And make sure that that change is small; make sure that that maintains unmitigated things. So I think it's very important when we make these changes that we realize that one of the advantages of a risk-informed change is it looks at everything.

COMMISSIONER APOSTOLAKIS: And why does it not apply to small breaks? Why should I do that only for large breaks?

DR. SHACK: You could certainly consider that. You know, it's a different approach. I mean, that's a policy decision but -- because it's wise to look at -- I think that the impetus has been the feeling that in fact the focus on the large break LOCA has, in fact, detrimental consequences. There are unintended consequences that make it affect other things in a detrimental way that I would suspect that it's not quite so clear that the design basis accident in the small break LOCA sense leads you to the same sort of problems. But again, in a conceptual sense as long as you're looking at the overall total integrated impact on risk I certainly have no problem with risk informing large parts of the --

COMMISSIONER APOSTOLAKIS: It's a good place to stop your answer. I like that.

[laughter]

Dr. Banerjee, do you want to say something about GSI-191? Why would I worry about recirculation if I'm not going to go there?

DR. BANERJEE: Well, I can't express the opinion of the Committee except my own opinion, because we haven't discussed this in the way that you're talking about. We have informally between the members talked about

this, and I think the point you're making is a very good one. That, if we are going to allow non-safety grade equipment to be used for breaks above the TBS size, why are we not looking at the highest risk sequences for smaller breaks and putting more emphasis on those and trying to understand what impact that would have on GSI-191? We have informally talked about this, but we have not reached any position about it.

COMMISSIONER APOSTOLAKIS: Yeah, and that's exactly my question. I'm not saying right now -- I'm not proposing that we should be using non safety related equipment for breaks below and so on. I'm not saying that we should give credit to operators. All I'm saying is that it seems that there is a huge gap between the level of attention we have been giving to large breaks, and for the small breaks, we're just having, you know, 50.46. And I'm wondering why that is. It seems to me that, as I said, there is a wealth of information out there that would inform decisions regarding smaller LOCAs, so it seems to me it's time that we looked into these things and not have these preconceived notions that, you know, we don't touch this, we touch that, and to expect to gain experience from something that is extremely rare. So that's all I'm saying. I'm not proposing solutions. And I appreciate peoples' concerns and the staff's concerns, of course, about risk-informing everything, but I just don't see us ignoring all this information. That's all I'm saying. I think Dr. Bley wants to say something.

DR. BLEY: A couple things: Again, strictly my thoughts. I much agree with you, but three things you said popped things into my head. On the good side of where we are, you said single failures, right? Rarely contribute. And of course that's because we've worked them out of the designs. That's our rule, and if you go to facilities that don't have that kind of rule, you find in some

chemical plants where I've been, you find single failures very important. But we've worked very hard to get rid of them.

But the next layer of things has importance. You said people don't include the operators because they are uncertain. Well, you need to remember that the operators are there and they don't not do anything because you didn't think about what they'll do. They will do the things that their training and the situation tells them to do and they'll make decisions. So there, you can't keep them out. They're there. So thinking about them is probably important from both sides.

And that comment that we may never get to recirc, if I'm an engineer I can show that very well and if I can just go operate the plant anywhere I want from those small breaks, I don't have to go to recirc. On the other hand, the safety analysis assumes a single failure and if that's a loss of one power bus, you lose one of your spray pumps, it's actually not conservative from that point of view because you actually, unlike the safety analysis you have all your spray pumps going, which will use up the water faster and push you to recirc sooner. And some actual EOPs block you from not going to recirc without some careful analysis by vendors and your staff's engineering company and current designs. So maybe those things you hear can't really happen that way, given the way the plant is.

COMMISSIONER APOSTOLAKIS: Yeah, the reason why -- excuse me -- yeah, I don't want to get into the reasons why a single failures are not -- It's an observation. Now why that happens is a separate story. Is it fair for me to conclude from the responses of the three distinguished members -- Dr. Corradini, control yourself --

[laughter]

-- that what I'm proposing makes sense. I didn't hear anybody objecting. Yes?

DR. ABDEL-KHALIK: To paraphrase a former colleague...

[laughter]

COMMISSIONER APOSTOLAKIS: Ohhhh...

[laughter]

DR. CORRADINI You didn't know you were being taped. It's still on. That's what happens.

DR. ABDEL-KHALIK: We just write the poetry.

[laughter]

COMMISSIONER APOSTOLAKIS: Thank you very much, Mr. Chairman.

[laughter]

COMMISSIONER MAGWOOD: Thank you, Mr. Chairman. So what would be wrong with risk informing small breaks?

[laughter]

Let me just give you a chance to perhaps -- and perhaps not speaking for your -- I'll direct this at Dr. Bley, not for your own perspective, what do you think are the reasons that it's been so hard to even have this conversation? It seems like whenever it comes up, it's almost like you're sailing off the edge of the world and there be dragons. Can you articulate for just for the record why we would not do this?

DR. BLEY: Well I think you asked the wrong person about why not to do it, but I, we've struggled for 30 years trying to get the ideas of risk involved

in this process. And it's come gradually. For many people it's new, even today. For others who haven't worked hard at it, there's a suspicion that it's not thorough and complete and could leave things out, but I think the way we've headed with risk-informed, is we have the design basis side to give us confidence in a subset of the plant and using the risks to get the broader view and look at the situations which aren't the standard set that are used in design basis thinking, and consider other possibilities makes us much more complete in our knowledge of what can go wrong and how you might help it get right. So for me, the balance is in favor of the risk-informed side, but I see people worry that all you do with that is erode margins and personally I don't think that's true. I thank you balance the margins throughout the broader range of things that could go wrong. So, I think that's one of the reasons, is people worry we're only using those ideas to nick away at the margins present in the conservative design basics.

COMMISSIONER MAGWOOD: Dr. Shack, anything you want to add --

DR. SHACK: No, I think I'll just agree with Dr. Bley.

[laughter]

COMMISSIONER MAGWOOD: I could not pass up the opportunity of following up on that dialogue so, first, let me thank the Committee. Let me sort of reiterate what my colleagues have already said. We recognize that the Committee is doing an incredible amount of work and they're under tremendous time pressure. We greatly appreciate it. And let me just give you the opportunity, is there anything we can do to make this period of work any easier, other than take less work away? Is there something, is there anything that the Commission can consider to do that would be helpful in assisting the Committee

to go forth with this -- because I know there's a lot of work coming in over the next several months.

DR. ABDEL-KHALIK: I really can't think of anything. We have not reached the point where we can't handle the load.

COMMISSIONER MAGWOOD: Excellent. Is this -- and perhaps a little bit of an historic perspective -- is this an unprecedented amount of work or have you gone through periods in the past where it's been --

DR. ABDEL-KHALIK: Perhaps some of the members who served much longer on the Committee can provide that historical perspective.

DR. POWERS: This is not the most intense period that the ACRS has gone through. There was a period in the early ’70s when the ACRS was looking at construction permits at ferocious levels. I think the challenge the Committee faces right now is because the way the regulations are written, we’re having to go to extraordinary detail and care on the design certifications because of the certain irreversibility that arises in the process. And these designs -- they’re very good. They’re a product of a large number of skilled engineers using highly, well-developed design capabilities. And what you’re looking for is what is not there. And that’s taking quite a little bit of time. And you’re not so much looking at what they present because that, quite frankly, is all these applications are just very, very good. And so we’re honing closely to try to find out where system interactions occur rather than looking at chains and things like that that we used to look at in the past.

So you’re right. Things have gone up and down and up and down. And the intensity -- it’s different now that it has been in the past largely because the industry’s gotten to be very good -- very capable in the safe design of plants,

including the designs against small breaks.

[laughter]

COMMISSIONER MAGWOOD: Well, thank you very much. I appreciate that insight. Dr. Shack, on Slide 26 of your presentation you use some terminology I wasn't familiar with and I was hoping perhaps you could help clarify. Maybe some of my colleagues are familiar with this. But I haven't seen the distinction between direct break sizes and indirect break sizes. Could you sort of elaborate on that a little bit?

DR. SHACK: Direct break size would involve essentially a degradation and failure of the pipe directly. An indirect break would be a pipe's pump support fails and that collapses and then that fails the pipe. So it's not really a failure of the pipe that's causing the failure of the pipe. It's the failure of the support that indirectly then results in a failure of the pipe.

COMMISSIONER MAGWOOD: And the size of these breaks -- how do they relate to the --

DR. SHACK: Well, you know, it depends. If you look in NUREG 4550 for the Surrey Plant, there's an indirect failure that takes out a recirculation -- a reactor pump and a steam generator. So you have a very large break associated with that failure. So, you know -- but it certainly could involve large pipes.

COMMISSIONER MAGWOOD: Excellent, I appreciate that. Thank you. Some of your remarks, you sort of -- you touched on the issue of the risk metrics for new reactors. And I was curious as to whether, as you've thought through the issues associated with GSI-191 and related issues, has that given you any particular insight regarding the direction things might take with the risk

metrics for new reactors. I wondered if you had any thoughts about that.

DR. SHACK: Well, the Committee has written a letter on that, and I think the staff has sent up a SECY to you with the Option 2. And we've supported essentially Option 2. But that's almost an option to, you know, continue to think further about this. And so I think that's sort of where the Committee is at -- is that, you know, we're thinking, but our thinking is not all aligned either.

COMMISSIONER MAGWOOD: No, fair enough. It's something we're still staring at as well. So I'll let you off the hook on that one.

DR. SHACK: That's one of the reasons I have problems with putting it into a rule.

COMMISSIONER MAGWOOD: Let's get back to Dennis for a moment. Slide, I think it was 59 of your presentation -- you mentioned that DAC can hide these unforeseen system interactions that might be uncovered if an actual design were available. First, let me ask an overall question about this before I dig down, even though time is running out. I get the clear sense that -- and as you've expressed -- that there's not a great high level of comfort with either DAC or how DAC is being implemented. Is that a fair characterization?

DR. BLEY: We have had a great deal of uncertainty about DAC and how it will be implemented. At the time we wrote our letter the uncertainty was still very high. From the subcommittee meeting we had, the uncertainty is being narrowed and, but as I say, the whole committee hasn't seen what we saw there. And the whole committee hasn't gone over the staff response to our letter. I'll pick a couple things and now again, it's just me.

There have been a lot of things laid out in the letter that are being

implemented by the task working group, and we haven't seen all of that yet, and were explained in our subcommittee meeting that show the -- I should pull up our two recommendations -- but that show that in fact the plan staff is working on now will involve the kind of expertise we wanted to see involved in the reviews of DAC closure. So I think before it was a matter of uncertainty and hearing different things from different people. Now it appears the process is being formalized and is moving toward that position to get the expertise we think is important. On the other issue of ACRS involvement -- in their letter they suggested we be involved in the pilot at South Texas project who were still wanting to be involved a little beyond that. And maybe, you know, to see how it works and to see if further involvement's important or not. I mean, it's new. Nobody's done it. We really hate going into it without knowing where we're going. And I think that's getting firmed up without a chance to make sure it's going in a direction we think supports the establishment of safety in the implementation that we've long expected.

COMMISSIONER MAGWOOD: I appreciate that. I think -- and Dr. Power's mentioned sort of in the context of design certification, these systems interactions that you mentioned in your presentation are the sorts of things that, as you pointed out, difficult to sort out in the inspection regimes. So I think the staff's letter does point out that it's not the inspections, but there's a wide range of documents and materials and analyses we're drawing on. So we'll look forward to your response to the staff's letter and understanding it a little bit better. But it is something that bears a lot of watching, so I appreciate your --

DR. BLEY: I think what we're seeing in that letter is they're formalizing what they mean by these things --

COMMISSIONER MAGWOOD: Right.

DR. BLEY: -- to an extent that hasn't between done before.

COMMISSIONER MAGWOOD: Thank you. Before I give up the mic, Mr. Chairman, let me just publicly welcome Joy to the Committee. It's good to have you back, advising me once again. Joy was an early member of the Nuclear Energy Research Advisory Committee at DOE, and as she can testify, I actually even took advice back then. But welcome, and I look forward to working with you. Thank you, Mr. Chairman.

CHAIRMAN JACZKO: This may not be a question --

[laughter]

-- but I'll maybe try and ask a question in the end. I listen intently to Commissioner Apostolakis' comments, and I think he certainly raises some interesting questions. I'm not sure if his questions are perhaps better understood in a context of more risk basing than risk informing. And that may be perhaps where some of the issues are. But I do find his questioning, I think, at the heart of one of the concerns I've always had with 50.46(a). Namely, I continue to struggle to figure out exactly why this is a risk-informed rule.

I remember when it first came in front of the Commission, I was new to the agency and I was new to this idea of risk informing and all these kinds of concepts. And so I readily studied what they meant and it basically meant the enhanced use of PRA in informing our decisions about safety. So I poured through the rule and I tried to find, where are we using the PRA? Surely the transition break size -- that's a derivative of PRA. Well, then I read through the rule and realized, well no that came out of an expert elicitation. So then I tried to pursue, okay, where's the risk information. Well, it's that small break LOCAs can

be more risk significant than large break LOCAs. Well, of course -- and following along, I think Dr. Bley's comments, that's the way our regulations were designed was to do everything to make sure large break LOCAs were not risk drivers. That's the basis of the design basis accident, so okay, so small break LOCAs are not risk drivers. Okay, well, that's telling us something.

So I continued to look at the rule. But then as I learned more and more about the rule, then things like containment spray actuation became an issue. A possible benefit of the rule -- relaxed diesel start times became a benefit of the rule. Possibility of power uprates became a benefit of the rule. And I failed to understand where was the risk information, where was the -- those were the things that seemed to be driving the rule. You know, and so to some extent, maybe I'm agreeing with Commissioner Apostolakis. I don't know that we've actually written a rule that's risk-informed. It's a rule that fundamentally says that a certain pipe size, based on expert elicitation, we will relax standards. I mean, that's another way to look at 50.46(a) rule. Now, I think the origin of that is because we think that right now with this system we have, those large break LOCAs are not dominant from a risk perspective. Okay, but that to me is a little bit circular in its logic. I mean, they're not dominant because we designed the plants for them not to be dominant.

So you know, I think it's a very interesting rule. I think, you know, clearly there is probably a need to comprehensively look at the ECCS System. And is it ultimately the way our regulations are designed allowing us to achieve the right kind of safety system or safety performance? And I think that would be a great rule. I'm not sure the 50.46(a) is that rule. And I think -- and again, it gets to some extent Commissioner Apostolakis' point that you know, below the

transition break size, we are traditional regulation. And above it, we are grudgingly pulling the staff along, I think, into accepting something less than existing 50.46(a). But still, and as the Committee has said, still requiring the ability to mitigate the beyond transition break size breaks in those situations. So, you know, and then if you pull in GSI-191 and then, of course, you get additional complications and perhaps a break size for GSI-191 from a risk significance is very different from a break size from a 50.46(a) perspective because there -- the relevant break sizes in fact may have more to do not with pipe size, but with pipe size combined with debris. If there is no debris around a large pipe, there is no relevance -- then there may not have been any fibrous insulation, if it's reflective in -- insulation, then there's no concern or at least a dominant concern for debris generation then there may be other sources of debris generation, such as material left in containment and things like that. But those can be addressed in other ways.

So as I said, there wasn't really a comment in there more just a question. I don't necessarily need everyone to respond unless George wants to respond, he's more than happy to. But so, you know, I think that there's some interesting questions, and I think it's fundamentally -- I still struggle with whether or not this rule is really a risk-informed rule or whether it's a rule that's intended to allow power uprates and to reduce diesel start times. I'm not sure that that's necessarily the best thing. I want to turn to -- oh, Annette never started my clock.

MS. VIETTI-COOK: Sorry.

CHAIRMAN JACZKO: That was a comment, not a question.

MS. VIETTI-COOK: I was intently listening.

CHAIRMAN JACZKO: Thanks. I did want to turn to the DAC

briefly. And I appreciate the Committee's thoughts on this. And we'll hear from the staff afterwards. This is an important issue, I think, for the Commission right now to address. We have in front of us or will have in front of us soon several design certs, the ESBWRB being one. We have the ABWR aircraft impact, although that issue doesn't necessarily address that. But and then the AP1000 where this issue may potentially rise again. So I think, certainly from my perspective, it would be better for the Commission to figure out what we're gonna do with DAC now, rather than to wait until the final rule stage in which we may come back then and say, "A lot of additional work is needed." I'd rather we say that now. But by the time we get to final rule stage, we have the ability to have that reviewed. So I appreciate the comments.

A couple just factual questions, one on the original ABWR design certification. Did the Committee at that time disapprove the ABWR with the inclusion of the DAC? I honestly don't know. I don't know if anyone knows. So they approved the design there. The AP1000 as well, which also has DAC in it -- did the Committee support the DCD and the first time we certified the AP1000 with the fact that it's a pain?

DR POWERS: -- pain. After a lot of pain.

CHAIRMAN JACZKO: Specifically around the DAC issues? So well, in that case, what was kind of the closure path that was followed?

DR. POWERS: Well, I think the applicant came in and revised his DAC to be much, much more specific than his going in position. And, you know, things evolved -- it was an enormous member of subcommittee meetings.

CHAIRMAN JACZKO: So are you seeing right now the applicants coming in with the same kind of modifications that would allow you to make those

approvals? Well, I guess, and again, I'm maybe asking that -- ESBWR the Committee has looked at and are the DAC an issue for the ESBWR?

DR. CORRADINI: Well, no, they're -- we had the same extensive discussion, such that the applicant kept on giving us more information until we were satisfied. I don't mean to put it so bluntly. But that's the way it came out. I think the one thing in the letter -- and I think Dennis actually said this in one of his ending statements, which I'll just repeat -- which is I think there is some, what I'll call a generic issue here, which is we expected, hoped, asked and we eventually got in discussion what we were looking for in some sort of independent whether it's digital or analogue, a functional logic diagram that explains if this happens, then this is to happen and this is connected to this. The equivalent to a PNID for piping is something that would have helped us in the review. I think the applicant, after many discussions with us and subcommittee meetings, we got what we needed. But I think that would have made it a bit more efficient. Okay? But I do think we did get what we needed.

CHAIRMAN JACZKO: Well that's helpful. So if I kind of take down the lesson, the ABWR -- I don't think there's any change with the aircraft amendment. That doesn't touch the DAC issue. So the ABWR, the Committee has final statements on. So DAC is not an issue with the ABWR. Of course that design is certified.

DR. ABDEL-KHALIK: Well, the expectation is and has always been that we would have another bite of that apple beyond the original design certification.

CHAIRMAN JACZKO: Okay, and so -- and again, if I've looked at the AP1000 from that perspective, so the Committee has approved it with the

expectation that they will further have another bite of the apple on the DAC?

DR. ABDEL-KHALIK: Correct.

CHAIRMAN JACZKO: Okay. And all of them then, I would go down. So the ESBWR as well?

DR. CORRADINI: No, I think that's a fair statement. I think Said said it best, is that the Committee in general, wants to be involved in some fashion in that process. How it's involved is still being discussed.

CHAIRMAN JACZKO: So those letters, the AP1000 and the ESBWR, were contingent on additional ACRS involvement in the subsequent work, the approvals there?

DR. ABDEL-KHALIK: I mean, we would automatically be involved at the COL stage.

CHAIRMAN JACZKO: Right, certainly at the COL stage.

DR. ABDEL-KHALIK: Right, and now the question is, if it were to go beyond the COL stage, would we still continue to be involved?

CHAIRMAN JACZKO: So were I'm hearing, I think, is that right now without perhaps changes or if we take the ESBWR, at this point, you got more information but not enough so at a COL stage this may be an issue for the Committee?

DR. CORRADINI: Well, I guess I'll frame it this way, is that -- and I'm sure all of the members will look at me since I'm probably not gonna do it to their satisfaction -- I think that at the DCD stage, we got the sufficient information to make the finding that we did. I think it took time and I think the applicant, to their credit, came back and gave us extensive discussion to the effect that satisfied us. In the next stage, we'll have to look at it when we come to the COL.

DR. SHACK: Well, I think another thing to say is that we approved it contingent on a satisfactory closure of the DAC process, which is something that we're continuing to work on. So we have the DAC we needed to make that judgment. What we need now is insurance that the DAC will be closed in a satisfactory way. And that's the discussion we're having.

DR. BLEY: To ensure the implementation meets the intent of the specification.

CHAIRMAN JACZKO: And tell me how that's different from kind of the normal process we'll have to go through with ITAAC and, I mean, if there -- right now there are ITAAC in the DCD that are tied to all these DACs. So with those ITAAC is the Committee comfortable -- I mean, again, is the Committee asking that at the post-COL stage, let's say, because, I mean, realistically most of these DAC are not going to be closed pre-COL stage.

DR. BLEY: That's what it appears to be.

CHAIRMAN JACZKO: That appears to be the case if we follow on. Because the design reviews right now are really pretty much the long poll in the tent in terms of most of the review. So these are all going to be closed most likely closed post-COL. So right now is what the Committee's saying is the ITAAC that are in there that are tied to those DAC insufficient to close out the DAC?

DR. BLEY: I'm gonna focus on kind of the difference between the ITAAC that are DAC and the other ITAAC. The ITAAC that are strictly inspection items, the devices here I've checked for the calibration works, the signals are right, you know, it does what it says it will do. Those are fine. Those are like the normal start up kind of tests from the past. But some of these are the DAC that

ensure that the implementation of the design and actual hardware and software meets all the expectations of the design specification including the links to the other details that are in tier two, tier two star and the technical manuals that back all that up. That's the part that requires some forms of analysis and that kind of analysis is the thing that we are still saying we'd like to be involved in and that we think requires expertise beyond that of a field inspector.

And I think the staff's response, at least agreeing on that part of needing that kind of expertise to look at those kinds of DAC ITAAC -- the ones that actually require understanding an examination of whether the job was done thoroughly and covered all the bases in checking out this implementation of the design.

CHAIRMAN JACZKO: Well, I appreciate that. Now just a last brief question I want to ask you. I think your presentation, Dr. Bley, you mentioned this -- there was an expectation that the DAC would be closed by the time of the COL issuance. Can you tell me where that comes from? Because as I go back and look at the history, there didn't ever seem to be a history – There didn't seem to be a history that that would be the case.

DR. BLEY: Where it comes from -- if you -- one of those early letters of ours talked about shifting the work to the COL applicant. You know, that was an indication, to me at least, that they were expecting the COL applicant as an applicant would complete those items. When I joined the Committee and raised questions and some of our meetings with others with members of the ACRS as well as with members of the staff long before the COLs came forward, there was a, "Well these will probably all get cleared by COL" kind of thing. So it's not in any of our reports except that one by inference.

CHAIRMAN JACZKO: And in terms of what the staff -- if you go back to the '90s -- and what the staff was producing on DAC, was there an expectation then that DAC would be closed by COL? I mean, was the staff communicating? I don't pick it up as I go back and research into the historical.

DR. BLEY: Not in anything I read. But there seems to have been in the discussions and, you know, the implications that show up in our letters back then.

CHAIRMAN JACZKO: Yeah. Okay. But nothing from the staff per say that would argue that? Again, I just want to try and --

DR. BLEY: Nothing in formal documents, no.

CHAIRMAN JACZKO: Okay. Well, I certainly appreciate the concerns that the Committee's raised and, you know, in a preferable world, I think I asked Bill Borchardt a question. I think I always mention this whenever DAC comes up -- that I think I once asked at a Commission meeting if there's anything Bill would think we could have done better or differently. I think he once said bravely, I have to admit, that "I wished we had never done DAC." And I think I probably, given the challenges that we have right now, would agree that it probably would have been better if we never had DAC. But we have them so we have to work with them. And we can't, at this point I don't think, change that system. So the goal is to try and figure out how to make sure we're meeting our safety requirements and go forward, and again, I think, to continue to encourage applicants to rely less and less and less on DAC, which seems to be the case. I think the APWR that's coming in has at least came in with no digital DAC. Now it may have added some as it's gone through the review process. So I think it's a movement in the right direction. So, again, I want to thank -- please if you had

any last comments.

DR. BLEY: I'm not sure about that. I mean, we haven't finished that review and if we don't have an implemented design, there must be something that, whether it's called that at this time or not, is like that. Because there has to be something that ensures that implementation meets all those criteria. So --

CHAIRMAN JACZKO: Well, thank you. Well, again, any other comments from my colleagues? Well, again, certainly as you've heard from everyone, I want to thank the Committee for their excellent information today and we will have a brief opportunity here from the staff, just on this DAC issue so that we're hearing all the information I think right now so that we have this as we're going forward and processing these applications in the near term. Thank you very much.

[break]

MR. BORCHARDT: Good morning, want me to get ready?

CHAIRMAN JACZKO: Sure.

MR. BORCHARDT: Tom has a short briefing that will go through the DAC issue. But just as a way of introduction and maybe to repeat a little bit of what was said earlier this morning, DAC was not envisioned as part of the original construction of Part 52. In the early '90s, we were reviewing the EPRI utility requirement document, the AP600, the ABWR, CE-system 80plus. And as part of that review, it became clear that for a combination of financial reasons on the part of the industry and evolving technology, most notably digital I&C, we would not be getting the kind of design detail that we envisioned in theoretical space when Part 52 was created. We were given the charge to try to come up

with a way of adapting to that new reality with a couple key conditions. One of them was that we needed to have a process that would allow the Commission and the staff to make a final licensing determination as part of the design certification rule and then the combined license that was issued. That's what gave creation to the concept of design acceptance criteria.

The only other point that I'll make before I turn to Tom is that I believe that from the very onset of DAC, and in fact, even from the very onset of how we tried to figure out how we were gonna do ITAAC, we always envisioned that there would be a combination of field inspectors and technical reviewers that went out to verify the acceptance criteria where in fact satisfied. Because even ITAAC -- we'll leave DAC to the side -- there are ITAAC that require a technical reviewer to be involved. They aren't all simple mechanical verifications that you can check the box. From the very outset, and in Mike Johnson's organization with Glen Tracy and the inspection program development, there is that coordination effort. How are we gonna get the key technical reviewers together with the field inspectors? They'll probably go to the site together or at least be so closely tied together that they could make a combined coherent final decision regarding the acceptance criteria in both ITAAC or DAC. With that, I'll turn to Tom.

MR. BERGMAN: Okay, still good morning. Before I get into the presentation, because this presentation and the ACRS is getting a little bit into an area of disagreement, but there is a lot of agreement, even in the area of DAC with the ACRS and I think that'll partly come out in the presentation and similarly on digital I&C, in particular, the four principles they call them, independence, redundancy, determinism, defense-in-depth and diversity and that fifth one

simplicity. And over the summer when we had some interactions with applicants, you may have seen letters that got to those issues. So there is a lot of agreement here. Slide three please.

Recent developments -- by recent, I mean, since the August 9th letter -- I look at August 9th letter as the beginning more so than the end, kind of flipping what the ACRS did -- brief background since that's been covered very well on design acceptance criteria. And then focus on DAC and digital I&C, as that is the one area of DAC that seems to have the most contention with it. The DAC closure process and then conclusions.

The ACRS letter of August 9th, we found that very helpful. I mean, we were aware that the Committee had concerns with DAC in advance of that letter. But by putting it in writing, it actually gave us something tangible to work to and we have met with various parts of the Committee since then. We met on September 7th, to better understand the issues in their letter and to help develop a meeting they mentioned on October 21st where we went through two DAC examples in great depth from how the DAC were created, licensed through closure to help come to a common understanding as well as they've continued to do the design specific reviews as earlier noted, in particular, the ESBWR. In that letter we found -- and this is our interpretation -- some underlying concerns. Leaving DAC open until after the COL was issued, that there was some relationship between level of detail in an application and safety, the lack of specificity or process nature, and that DAC are overused, that digital I&C systems have changed since DAC were originally conceived, and that they require expertise in judgment to close.

I can pretty much skip this. I think you've heard the

recommendations, one and two. I'll save a bit of time there.

The staff response on October 7th was with respect to recommendation one, we agree -- as Bill's already mentioned -- technical expertise is required, and that isn't just on DAC inspections. It's on many inspections. Inspectors are experts in their own right as well. We do propose a role for the ACRS in DAC closure consistent with what we see as their past practice. And I'll get into more detail in this later. And on recommendation two, we agree it is preferable to close DAC prior to the COL issuance. But it's also acceptable to do it afterwards. That is an area of potential disagreement. And we also agree that regardless of when DAC are closed there needs to be a consistent scope and depth of the evaluation.

On our assessment of other issues, a key one is -- it came out of the September 7th meeting -- is that -- and potentially, if you read those early 1990 papers on DAC, can lead to the conclusion that the DAC are the safety basis. And they're not. They're part of it in particular, the way we've implemented it with process oriented DAC and putting the system performance characteristics in what would be the FSAR portion of the application. But when you look at the application in total including the DAC, the safety finding can be made. We think we should continue to allow DAC where appropriate. And again, use technical expertise and good inspection procedures during DAC implementation. Next slide please.

The DAC policy, just real briefly here, it's been consistent now over almost 20 years. DAC should be objective. The design certification, including one that relies on DAC is the final safety determination, meaning from a safety review standpoint or licensing perspective, the review is done -- and I heard the

term we've even used in our own staff -- another bite at the apple. And we've had to be clear to our staff: it is not another bite at the apple when we close DAC. The licensing review is done. That's a verification activity, not a reevaluation of the safety basis of the design. It's been a learning in our own staff as well, that the additional design detail that's developed as you go through the DAC will not alter the safety conclusion. It flushes out the design and tells you how it will work, but it should not undercut the information about the design in the certification itself. And it's limited to a few areas, currently, now three -- piping, human factors and digital I&C.

And this policy's been periodically, what I would call reaffirmed. We sent you the first paper, the 92-053, as well as the last time we formally came to the Commission, a memo in 2008. But in between there, there've been a number of other papers and, of course, the four designs that got certified and are not in appendices A through D of Part 52.

When we get to digital I&C in DAC, digital I&C DAC have been used in all four certified designs. And they're used in all four under review with one exception. And because those reviews aren't complete, the numbers are subject to change. But currently, one of them has no DAC for digital I&C.

With digital I&C, some design flexibility may be desirable. In fact, 15 years is a long time for digital I&C. And in the only two applications we have that refer to an already certified design, South Texas Project and AP1000 amendment, where they specified specific technology, they've actually requested changes to that as a result of technology evolving in that 15-year period. Having said that, the use in digital I&C appears to be declining. That's just an observation. We don't know that it's a trend. The next one could come in with a

full set of DAC. It could be driven by the fact that Areva and Mitsubishi have fairly complete designs as a result of their design and construction activities outside the U.S. So we don't know the basis.

Another observation is that these later designs may not be amenable to DAC. And that's because partly what the ACRS pointed out, as the design complexity increases, and by complexity, we mean interconnections between either safety divisions or safety and non-safety systems, the level of information the staff needs to make a safety finding that in fact independence, for example, is preserved, you need such a complete design that you would have satisfied any DAC that were present. So they work themselves out of DAC just through the application in order to satisfy the safety finding. Next slide.

DAC and ITAAC closure is really a verification of the licensee's activities to meet the DAC. It's the licensee's responsibility or the applicant's if we're talking during a COL review, that they have met the DAC or the ITAAC. The staff verifies that activity. And that resultant design must satisfy both the acceptance criteria in the DAC or ITAAC as well as the licensing basis that exists in the FSAR at the time. They can't -- it's not an "or.", there's definitely an "and" in there.

DAC inspections -- we do plan to inspect all DAC. We are developing inspection procedures specifically for DAC. And it's different -- there's a different procedure for each of the technologies, as well as within I&C within each of the different design phases that are in I&C. As already mentioned, we will use subject matter experts for DAC. We never envisioned those to be quote "simple" inspections. I'm not sure how many inspections are truly simple. But DAC are definitely complex and in part of our role and my role in the division

of engineering is to work with our construction inspection program and Region II to make sure we're providing the right technical support for those inspections and others that we support. Digital I&C DAC inspection procedures are being tested on the South Texas application. The phase one, the planning phase, of digital I&C development was completed in June -- partially completed in June. And we did find that the inspection procedure that we used in that inspection was sufficient and useable by the staff. And we did have staff from my division participate in that inspection. Next slide.

The staff proposal to the -- response really -- to the August 9th letter was we did propose a role in the inspection program for DAC. It's similar to the role they played in the development of the reactor oversight process. It discussed the strategy for the program. We've been sending them the inspection procedures for review. And they will get the opportunity to review the first implementation of South Texas. We do believe that's sufficient involvement to ensure that that process works.

In conclusion, the safety finding is made on the entire application, not just the DAC. The safety review is complete, DAC closure, just like ITAAC closure, is a verification activity. We think we should continue to allow the use of DAC where appropriate and use of technical expertise and sound procedures to verify DAC implementation. Thank you.

CHAIRMAN JACZKO: Thank you. Commissioner Ostendorff.

COMMISSIONER OSTENDORFF: Thank you, Mr. Chairman. You briefing is very helpful. I appreciate it. I really just have two questions. One is, as this whole process has evolved and as the staff has gained experience in reviewing the different licensee applications for the design certs, has it evolved to

the point where you have a model or a best practices DAC that really can serve as an example to hold up this thing? This is -- kind of provides boundaries for what is or is not appropriate for DAC with respect to digital I&C?

MR. BERGMAN: Yes, we certainly learned over the past 15 years -- in fact, if you look at the ABWR, that was the first application with DAC to ESBWR, which is the last application that has what we call substantive number of DAC -- there has been progress. A simple one is in the ESBWR application; they actually indicate which ones are DAC versus which ones are not as opposed to leaving it up to the inspector or reviewer to figure that out. But in general, DAC -- especially in digital I&C -- deal with the earlier phases in the I&C development, planning requirements, development. ITAAC deal with implementation of those activities with as-built equipment.

So yes, we are learning they do get better. As an example, the division of construction inspection in operational programs reviews ITAAC and DAC for inspectibility: can an inspector can actually use this in the field? So we think the ITAAC and DAC have improved over time.

COMMISSIONER OSTENDORFF: Okay. A second question concerns the NRC staff's views of the ACRS role in DAC closure and any deltas or areas that still have not been resolved. And I heard from my Commission office staff is there have been some really good discussions between the staff and ACRS here in the last couple months and that there's been much greater understanding on both ends as to concerns as well as understanding about the ACRS of what the staff's procedures would be and what the scope and comprehensiveness would be of the staff's inspections. So I think -- is that your assessment that these communications have been helpful to somewhat close the

gap?

MR. BERGMAN: Oh yeah, the dialogue since August 9th has been very helpful. I don't want to -- they can correct me if I'm wrong. But I think, up to the point of COL licensing, we have a good understanding of what's appropriate for DAC, what's not, and how to work through it if there's differences. The one open issue remaining is how involved should they be post COL licensing?

COMMISSIONER OSTENDORFF: And can you maybe summarize where the delta is on that aspect?

MR. BERGMAN: Well, I think what we've proposed is this limited -- help us make sure the program is sound, make sure the procedures are sound and use the first application, the South Texas application, to demonstrate the validity of that process. What I heard from the ACRS as well as today is they would like to be involved in DAC closure for other applications as well. Whether that's indefinite or just the next few, I don't know. That would be something we would need to work out if that were a decision that we needed to incorporate that.

COMMISSIONER OSTENDORFF: Strictly with respect to the South Texas project case, just for that one application, is the role pretty much agreed upon as to how ACRS would be involved in that case?

MR. BERGMAN: I believe so. We brief them after we complete the inspections.

COMMISSIONER OSTENDORFF: Okay, thank you. Thanks, Chairman.

COMMISSIONER SVINICKI: Thank you for the presentation on that dialogue just now. I think I would just build on the question that Commissioner Ostendorff was asking you about what staff has proposed, the

discussions you've had. And I know that the Committee still needs to send some formalized response to that. But if the staff has proposed involvement with South Texas, what is the staff's biggest concern if that were to continue beyond South Texas? Is it the propagation of a role that is somewhat unique of having them involved post COL issuance for each of these? Or is it a resource issue? Is it on the critical path? What would be staff's biggest concern about perpetuating it beyond South Texas?

MR. BERGMAN: It's a little of all of which you've mentioned. We would need that role to be very clearly defined because during construction, the schedules would be even more demanding than they are during licensing. And then there's sort of a practical manager aspect and a policy aspect. The practical manager aspect is, whose eyes -- if we need to do more on DAC closure, whose eyes are the right eyes? And what will those eyes not do when I have them do this? So if the concern is that the staff needs to look more thoroughly at the systems that are being closed with DAC, I think the staff is in the best position to add the right expertise to do that activity.

COMMISSIONER SVINICKI: And you could conceptually get the ACRS's view on that aspect by having them look, as you said -- does the program have integrity in all of the procedures correct. So if it's a systemic vulnerability of what you've designed, they could in theory tell you that by looking at just the overall program from its establishment for the closure of these DAC ITAAC.

MR. BERGMAN: That's correct.

COMMISSIONER SVINICKI: Okay, and so a little bit though, if I flip that question, is the concerns you have, you really kind of have them even for

South Texas then. But is that offered in a spirit of saying, “We need to make the Committee more comfortable and so this would be a way of doing it?” Because the kind of -- you verified the concerns that the staff had. In theory, those apply to South Texas as well.

MR. BERGMAN: Yes, it’s part, say, “Hey, it’s the first time. Let’s let you in.” The other difference is South Texas actually doesn’t have their COL yet. This is an agreement we worked out with that applicant to work through some of the DAC closure activities prior to COL licensing. So they’ve well ahead of the schedule of somebody who would be getting a COL license.

COMMISSIONER SVINICKI: Okay, so although they don’t know the ACRS’s formal response to what you put forward, that could be an issue in and of itself because if their concern is about -- or one of their greater concerns is about DAC closure after COL issuance, then you’re not really in your pilot, as I think someone called it, doesn’t really take you into that regime anyway.

MR. BERGMAN: I should clarify that. Although we are doing it in parallel with the licensing review, the COL would be issued before the DAC were actually closed. We’re testing the process with the applicant. They will not be closed prior to COL issuance.

COMMISSIONER SVINICKI: Okay. All right, but it still is being done, as you’re saying, in a unique way, so that if you want to use with the ACRS are offering up a case that is gonna be really typical, this sounds like this one is being addressed in a little bit different sequence at least. So they -- we’ll leave it for the -- I’ll stop positing what the ACRS might rebut to your offer. So we’ll await that answer. Thank you, Mr. Chairman.

MR. BORCHARDT: If I could just add two comments to that. One

is that we've got to be very careful, I think, not to lose sight of the fact that we need to make a final licensing decision when we issue these licenses. And we can't rely on an ability, second bite at the apple, kind of issue to say, "Well, we'll approve something that doesn't quite meet the standard because we'll have the change to look at it again in the future." I don't look believe, if I look at Steve, would hold --

STEVE BURNS: You are correct Sir.

MR. BORCHARDT: Thank you. The other point that I'd like to just add is, we're never driven by schedule; however, the schedule of pressure will be intense, especially for the first half dozen plants that get built. When we first put together Part 52 and thought about this, you know, we had in our dreams the some very steady state and moderate level of ITAAC activity that would be evenly distributed over four years of construction. That's not gonna happen either. So it's gonna be very back-end loaded. And there will be a lot of stress put on all the organizations to get that done.

CHAIRMAN JACZKO: Commissioner Apostolakis.

COMMISSIONER APOSTOLAKIS: Thank you, Mr. Chairman. Others have mention the same thing. But on Slide 4, you say that one of the concerns is that the concept of DAC has been overused. And then on Slide 7, you say that the staff will continue to allow use of DAC where appropriate. So the question I have is, have you ever had a case where an applicant wanted to declare something as DAC and you said, "No, you're not gonna do that"?

MR. BERGMAN: We generally question whether DAC are appropriate. And two specific that are still coming forward on the Areva review, they currently have two DAC, one with the post-accident monitoring system and

one with the safety related visual display unit. And both of those, we are questioning the need for DAC on both of those. So we do question. And it does depend on the degree of design maturity that the specific applicant has, is really what drives the number of DAC. But we haven't had identified to us where there are DAC that simply are unnecessary. We would need specifics on that.

COMMISSIONER APOSTOLAKIS: Is it naive to think that maybe some applicant in the future will propose so many DAC that in fact you will deny certification?

MR. BERGMAN: We have to have enough information about the design, what its capabilities are, what its safety functions are, how it will perform those functions, to satisfy the technical requirements that exist. So we would -- through the process of review, through RAIs, we would get that additional information till the point we reach that. The answer is, it's possible. We usually fix the application rather than ship it back.

MR. BORCHARDT: I don't think we would see that because as was mentioned in the earlier panel too, using DAC shifts some of the risk to the COL holder. That's not good business practice I would imagine. That's not something we review. But I don't think the industry would allow that to happen.

COMMISSIONER APOSTOLAKIS: I don't have another question. But I found it interesting that you said that in early applications the applicants did not even identify the DAC. So you had to figure out which ones were DAC?

MR. BERGMAN: Well, the people who reviewed at the time may have known. But they didn't actually put it on the sheet of paper that's the DAC and say, "This one's the DAC." That was something that was -- I believe the first time it was done on the GEH application. And it is helpful just because you see

what the bin is. You can infer which are DAC from the subject matter. But they clearly identified which were DAC and which were not.

COMMISSIONER APOSTOLAKIS: That's not the case anymore. Now you know clearly, they come and say, "This will be a DAC."

MR. BERGMAN: I believe so. I haven't seen the other applications, but the numbers on AP1000 amendment, the EPR and Mitsubishi are very small in number.

COMMISSIONER APOSTOLAKIS: Thank you, Mr. Chairman.

CHAIRMAN JACZKO: Commissioner Magwood

COMMISSIONER MAGWOOD: Thank you, Chairman. Just first, thank you for the presentations. They were very helpful. My understanding of the term second bit at the apple, I should let the Committee speak for itself. But my understanding was that they were speaking about the ability to look at the DAC after design certification but during COL review, as opposed to sometime after. So I think, just make sure that we're biting the apple at the right place. I think what they were saying was valid. I think it's actually part of the process.

One thing I wanted to ask about. As you look at the post-COL review of DAC, one of the things you've raised is the impact on schedule. And I realize the schedule was going to be very, very tight with these things. But at the same time I don't know that that's the reason it in of itself to not allow for ACRS review. I think that we want to make sure that we're looking at these things very closely and very carefully. And in that respect, I have a question about the staff capability to do these reviews. As you anticipate both the inspection procedures and the inspections themselves, are these going to be conducted by NRC staff or do we have to look to contractors to do that?

MR. BERGMAN: It could be a mix of both. I mean, we have substantial capability in the Office of New Reactors for digital I&C. But we anticipate, if necessary, we would use contractors.

MR. BORCHARDT: Just as an order of magnitude -- I think, you know, about a third of our review work is contractors. It's less than that for the inspection program. Those kinds of activities and the Region II schedules that are being made up, if you get down to Region II and look at their inspection planning tools, it loads and identifies where DAC is, when it is going to need to be a technical review or an addition to a field inspector.

COMMISSIONER MAGWOOD: All right, I appreciate that. Also, I wanted to follow up on something else you mentioned. I think you indicated that some of the more -- some of the later applicants have technologies in the digital I&C that are maybe too complex in effect to make DAC practical.

MR. BERGMAN: In order for the staff to confirm that the design proposed meets the regulations, the design needs to be so mature that it's past the point where we typically would see DAC used. They've just provided the -- you use DAC where the design hasn't gotten far enough in the design process to provide the details for a -- I'll try to use a simple example, if you have a -- it's really a digital equivalent to an analogue system where you've just substituted digital components for analogue components, but there's no interconnection between the four divisions. You can essentially make the call that you have independence between those divisions by looking at a figure because they don't interconnect. What we see on later designs is there is some sort of data bus connecting the different divisions. Now you need to understand what is the equivalent of space? How are you preventing bad data, corrupt data from

moving from one division to the other? So they have to provide an additional level of design detail. So we can conclude that in fact independence is preserved. And once you got that detail, you didn't need a DAC anymore. They've satisfied you with a detailed design that in fact independence is preserved.

COMMISSIONER MAGWOOD: I see. So in effect, the applicants have, in order to even come close to providing a complete application, have to provide a lot more detail than they would have with a less sophisticated approach.

MR. BERGMAN: Yes.

COMMISSIONER MAGWOOD: Interesting.

MR. BERGMAN: We anticipate that the licensing basis information, if we find these complex designs even acceptable, is gonna be substantially larger than it would be for a simple design.

COMMISSIONER MAGWOOD: So if you have a dumb plant, DAC is okay?

MR. BERGMAN: If you have a simple design, which is good from a safety standpoint and good from a cyber security standpoint -- they work in parallel on this -- state of the art designs can be very simple, very sophisticated. To the operator they'll look the same. VDU's, everything -- it's the guts behind the screen that's simple.

COMMISSIONER MAGWOOD: I appreciate it. Thank you, Chairman.

CHAIRMAN JACZKO: I just have a question. I mean it seems part of the issue, we look at post-COL closure, is what does it mean to close a DAC.

We know ITAAC -- we know what happens with ITAAC. There's a very prescribed process. The Commission has to make its 103G finding certifying that all ITAAC are complete before they can commence operation. What would it look like for a DAC to not be closed? I mean, what does that mean? What does that process look like?

MR. BERGMAN: Well, DAC or ITAAC -- it should follow the same processes – there would be a closure letter, everything.

CHAIRMAN JACZKO: So there would then be -- if there was a problem with the DAC closure, then we would not be able to make the 103G finding effectively. So it has that formal way.

MR. BERGMAN. Correct.

CHAIRMAN JACZKO: Are the DAC themselves the ITAAC or do the DAC get kind of derivative ITAAC that implement the DAC?

MR. BERGMAN: For every DAC, there's a parallel ITAAC that gets -- so the DAC covers the design process. There's an ITAAC that verifies the implementation of the design. So there's both.

CHAIRMAN JACZKO: I mean, can you have a possibility in which they fail to follow the design process and the ITAAC is still satisfied?

MR. BERGMAN: We should be able to catch that. We should catch that at the DAC closure stage, right? And again, the design still needs to meet the licensing basis. So both of those. I'm cautious when saying, "Can you" and "Is it in the realm of possibility".

CHAIRMAN JACZKO: Let me tell you because you don't have eyes in the back of your head. That seems to be a point of -- based on the faces I saw -- that might be a point of importance, is that possibility. I mean, I guess it

gets down to what is the -- I wonder if we should put a mirror up here or something so you can -- that may be a point of contention.

[laughter]

Effectively, if the ITAAC are satisfied, but they follow a different process, then is the design safe? I mean, I guess that may be -- is the issue. Because the ITAAC are not necessarily a safety determination. They're a compliance determination.

MR. BERGMAN: They confirm compliance with a licensing basis. You can meet the DAC with a wide variety of designs. That's the flexibility they allow. So you could have -- that was one of the arguments against DAC, was they potentially undercut standardization. So you can come up with a spectrum of designs that meet the DAC. If they follow the processes in the DAC, it should result in an acceptable design. And it's still -- that acceptable design needs to be confirmed that it meets the licensing basis, excuse me.

CHAIRMAN JACZKO: Through the ITAAC.

MR. BERGMAN: Through the ITAAC.

CHAIRMAN JACZKO: Okay. Well, I appreciate that. And I think that's -- certainly as I hear the issue, probably the crux of the issue there is that since there is flexibility in that regard with the different designs that could in fact satisfy the DAC, that that appears to be, to me at least, maybe where that disagreement is stemming from -- is that to what extent -- how in fact are you verifying that the design meets the DAC and not -- and again, since we're in a post-COL phase, we're not in a licensing review phase, we are in some kind of compliance phase. So the DAC has to be clear enough that it is not a review question, but it's simple a verification question.

MR. BERGMAN: It is a verification question.

CHAIRMAN JACZKO: And so in your sense right now, that's clear.

MR. BERGMAN: Well, for me to do it, no. For appropriate technical expert, yes, because they actually get into -- the DAC aren't stand alone. When you implement the DAC, it kicks you into things like NUREGs, regulatory guides, consensus standards, that the expert understands how to implement all that. That's what provides the rigor that defines the limits on what kinds of designs come out of that process. But you can come out with a lot of different designs.

CHAIRMAN JACZKO: Well, thank you. That's very helpful for me, certainly and I know the Commission will certainly have a lot of thinking to do on this. And I don't know if anyone has any other comments or questions that they'd like to ask on this? Again, I want to thank both -- certainly the ACRS for their excellent presentation and the staff for coming and clarifying this one issue.

[Whereupon, the proceedings were concluded]