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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

SUBCOMMITTEE ON THERMAL HYDRAULICS PHENOMENA

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TUESDAY

SEPTEMBER 7, 2010

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 1:00 p.m., Sanjoy Banerjee, Chairman, presiding.

COMMITTEE MEMBERS:

SANJOY BANERJEE, Chairman

SAID ABDEL-KHALIK, Member

MICHAEL CORRADINI, Member (via teleconference)

MICHAEL T. RYAN, Member

WILLIAM J. SHACK, Member

ACRS CONSULTANTS:

THOMAS S. KRESS

GRAHAM B. WALLIS

ACRS STAFF PRESENT:

MICHAEL BENSON, Designated Federal Official

ILKA BERRIOS

TIM COLLINS

STEPHEN DINSMORE

CHRISTOPHER HOTT

JOHN LEHNING

TIM LUPOLD

BILL RULAND

MICHAEL SCOTT

STEVE SMITH

JOHN TSAO

ALSO PRESENT:

JOHN BUTLER, NEI

TIM BOWMAN, STP

TABLE OF CONTENTS

P R O C E E D I N G S

1:02 P.M.

CHAIRMAN BANERJEE: The meeting will now come to order. So this is a meeting of the Thermal Hydraulics Phenomena Subcommittee. I'm Sanjoy Banerjee, Chairman of the Subcommittee. ACRS members who are here are Chairman Said Abdel-Khalik, Michael Ryan, William Shack, John Stetkar may arrive. He hasn't arrived yet. Mike Corradini will not arrive, but will be listening on the bridge line. And we will be asking questions. And we have also our ACRS consultants, former ACRS members and actually the Chairman, Graham Wallis; and Thomas Kress, known as Tom Kress.

MEMBER RYAN: And Dennis Blye will be coming also.

CHAIRMAN BANERJEE: And Dennis Blye will be coming too.

Ilka Berrios of the ACRS staff will be supporting this meeting.

The purpose of this meeting will be to review the staff's policy paper on potential approaches to resolve Generic Safety Issue, GSI-191, which relates to assessment of debris accumulation on PWR sump performance. We will hear presentations from the NRC staff and the Nuclear Energy Institute and do we also have a presentation by STP?

MS. BERRIOS: STP.

CHAIRMAN BANERJEE: Okay, they will be in the slot we've allotted to the Nuclear Energy Institute.

Just as a little bit of background, the staff policy paper that we've been listening to responds to the Commission's staff requirements document, dated May 17, 2010. The SRM followed an industry briefing of the Commission which led to the Commission asking the staff to stay issuance of letters to licensees under 10 CFR 50.52(f) or something.

MR. SCOTT: 50.54(f).

CHAIRMAN BANERJEE: 50.54(f), thank you. And also asked the staff to submit a notation vote policy paper on potential approaches to bring GSI-191 to closure. And this is really a discussion of options which was to address ALARA policy concerning radiation dose worker, hazardous material exposure, and risk-informed versus deterministic treatment of the issues involved. There are various other requirements which I'm sure Mike Scott and Christopher Hott will tell us all about, the SRM. And really what it has resulted in is that you stayed the issuance of these letters now and put together these options which will be decided on fairly quickly.

I should mention though that the ACRS has considered this matter previously in a lot of detail and the course that the staff was following had our full endorsement up to this point as have stated in our 2008 letter.

So with that, I'm going to turn it over to Mike Scott and Christopher Hott. You put in your time, if you possibly can, and go ahead.

MR. SCOTT: Good afternoon. As always, it's a pleasure for us to come and brief the Subcommittee and the Committee on current events of interest related to GSI-191. As Dr. Banerjee has referred to, we've made a number of presentations over several years on this subject. We have great ambition to close the safety issue as soon as we reasonably can. And the path that we take to get to closure is really what we're all about today, along with the time frame associated with it as that is reflected in the staff's SECY paper that Dr. Banerjee referred to.

Today, most of the initial presentation will be done by Chris Hott to my right. Chris has been the lead for development of the SECY paper. As I think you probably have observed from reading that paper, it was a highly complex undertaking to get it together in a very short amount of time. It required interactions with a number of different people, both inside and outside the Agency and Chris did a real stellar job making that happen. We actually got it in a day or two early to meet the Commission's deadline. So we're very pleased to talk to you about it today.

After Chris speaks, we'll have presentations on a couple of the areas of particular interest associated with the SECY paper. So with that, I'll turn it over to Chris.

MR. HOTT: Thanks, Mike. Can we go to the next slide?

Good afternoon. Dr. Banerjee mentioned we're here to provide background information on the SECY paper. We're going to also give a status update on GSI-191 activities. We want to discuss stakeholder views. We'll brief you on the approach used by the staff in responding to the staff requirements memorandum that followed the April 15 Commission meeting. And we'll also provide a rationale for the staff's recommendation in the SECY paper.

GSI-191 focuses on reasonable assurance that long-term core cooling will be maintained in the presence of debris in the containment sump following a loss-of-coolant accident. Regulatory requirement to maintain long term core cooling is in 10 CFR 50.46(b)(5).

Generic Letter 2004-02 which was issued September 13, 2004, requested licensees to evaluate ECCS performance in the event of a loss-of-coolant accident and to notify NRC of the analysis method and the analysis results including any planned modifications that were needed as a result of those analyses and to make any needed modifications by the end of 2007.

During this time everyone thought, including ECCS, that near term action to make strainers larger was the right thing to do, when to date, all licensees have increased their strainer sizes by one to two orders or magnitude. In some cases, the modifications were made before validation testing that larger strainers would be enough. And the assumption was that larger strainers would not clog and that the subsequent strainer testing would validate that assumption.

Next slide.

However, as licensees began performing strainer tests, the NRC staff found issues with some of the testing and some test results called into question the assumption that large strainers would always be sufficient to address the issue. Through these tests and others, our understanding of the issue has improved. In many instances, aspects of the issue have been found to be more significant than initially thought. This was the case for the order of debris arrival at the strainer, chemical effects, and the thin-bed effect.

DR. WALLIS: No, no. These things have been going on for a long time, but we keep having new effects which need to be resolved. Is there any assurance that this isn't going to continue along this same pattern?

MR. SCOTT: I wouldn't say there's ever assurance in GSI-191 that something new isn't going to crop up. We had an experience at the beginning of this year where unexpected in-vessel effects test results occurred, so we're certainly not here today to say that everything is all good to go. As long as more testing remains, which is the case we believe, there is always the potential for unexpected occurrences.

However, we have largely gotten to the population of issues to be whittled down and we are whittling them down. For example, as Chris will talk about, most plants now or most vendors -- let me change that, all vendors now have a test protocol that the staff has accepted as conservative or prototypical. And those are test protocols that don't credit debris settlement.

So the issues that remain are fewer in number than there were before. That said, this issue has a history of unexpected development. So there could be more.

DR. WALLIS: There always seem to be four or five that are unresolved no matter where we are. I just wondered if you hadn't sought for solutions which were immune to this discovery of new effects when you do new tests. Isn't there some approach you can take which is immune to this rediscovery all the time of difficulties?

MR. SCOTT: We're certainly not aware of it or we would have gone down that road. Did you have something in mind?

DR. WALLIS: I do, but I'm not going to suggest it at the moment.

MR. SCOTT: Okay.

DR. WALLIS: I'm just asking you, you must have searched for strategies which didn't keep coming up with these, like this, the things you still have to worry about.

MR. SCOTT: We have had a number of strategies to address GSI-191 and they have often changed due to new developments.

DR. WALLIS: That's very evident from the documentation that you gave before to me.

CHAIRMAN BANERJEE: Well, I think this could go on for a while. The last round we had with the staff, we came to some sort of agreement that this strategy that you were following was one which was likely to lead to eventual success which was that you had come up with certain test protocols which appeared to us to be satisfactory, using surrogates for chemical effects which seemed to us to be satisfactory.

So basically, I think you were on the path to closure of this issue, not with regard to in-vessel effects because that is a separate issue which you will see how that comes up. But everything else I think we had the feeling you were moving to what's closure and perhaps it would require insulation to be removed from some of the plants and so on. Eventually, you'd get there. So in sort of answer to your question, our 2008 letter said that essentially and in some ways it's sort of a little bit surprising that this process has been interrupted because it seems like it had been going on quite okay. At least that's my personal opinion.

MR. SCOTT: I think it would be accurate to say that we are on a path to closure from the perspective that we are now in acceptance of the test protocols of two thirds of the plants.

CHAIRMAN BANERJEE: Right.

MR. SCOTT: So as long as the plants involved conduct their testing as they have told us in writing they plan to do or already have done and as long as they agree to make whatever changes are indicated by that testing, if any, then we consider the issue largely resolved for those plants and that's two thirds.

So we are progressing towards closure. That said, in some sense the more difficult challenges remain because those tend to be the plants that have the higher loadings of problem material.

DR. KRESS: Has the Subcommittee or ACRS reviewed those test protocols?

MR. SCOTT: I don't recall.

CHAIRMAN BANERJEE: We have them available. We haven't reviewed them specifically, but they're very much in line with what the Subcommittee and the staff have discussed.

MR. SCOTT: We certainly have discussed at great lengths with the Subcommittee the issues we had with the previous protocols and what we thought to be an acceptable protocol.

CHAIRMAN BANERJEE: So we have those procedures. We haven't officially reviewed them and given our opinion on them, but we are suddenly aware of them and they take into account a lot of the things that we've had discussions on with regard to your prototypicality and you know, suspension, all these factors that we were concerned about.

MR. SCOTT: Bill Ruland, did you want to say something?

MR. RULAND: If I may, Dr. Banerjee, just for clarification, the staff has not endorsed or approved a certain strategy that licensees could use to resolve GSI-191. Rather, we enforce our criteria. And licensees have chosen to enlarge the strainers and continue in that vein. No licensee has shown to -- has chosen to backfit a safety grade of back-flush system. Surely that would have been a different approach. It would have been an approach that would have been governed by the operators, but no licensee has chosen that approach. So again, we're just reviewing and accepting or not, the methods and methodology that licensees have chosen to resolve this issue.

DR. WALLIS: So meanwhile, these licensees are all out of compliance with some regulation? Is that not the case?

MR. RULAND: The NRC has gone on record in General Letter 2004-02 that we believe that licensees were safe to operate while this issue was resolved and we continue to believe that.

DR. WALLIS: Can't that go on forever?

MR. RULAND: Obviously not and that's why we're here and that's why we issued the SECY paper at the direction of the Commission and hopefully we get your endorsement or not about how -- what our approach is.

DR. KRESS: What was the basis of this, assuming that they are continuing in safe operation? Is that a risk-informed --

MR. SCOTT: There were risk elements to it. It was partly based on the low probability of the initiating event. It was also based on the large number of mitigative and interim actions that the licensees took in response to Bulletin 2003-01.

DR. KRESS: The larger filter sizes?

MR. SCOTT: That was not part of the original documentation in 2004-02, but it certainly has improved the situation since. That was more along the lines of the -- the bulletin was more along the lines, for example, of do you have the capability to refill the refueling large storage tank and continue injecting it if the strainer should become clogged, those kind of actions which were plant specific in which the staff reviewed after the issuance of the bulletin.

So there were a large number of factors that played into that decision. And it's documented in General Letter 04-02. Since then, as you pointed out, the strainers are larger, so the situation is clearly better than it was in 2004, so we continue -- as Bill Ruland said, we continue to believe it is acceptable for the plants to continue to operate, but as Dr. Wallis implied, we don't consider it a good idea that this go on indefinitely. And hence, we have put a plan of action into play and recommended to the Commission a path forward to bring it to closure in a reasonable amount of time while recognizing the obstacles and issues that are associated with that path forward, which we will outline to you today.

DR. WALLIS: Did someone estimate the probability of success of the strategy?

MR. SCOTT: Again, the strategy that we have in place is plant-by-plant resulting in addressing the issues.

DR. WALLIS: But I mean there must be some assurance that this is going to work, rather than just a gut feeling. There must be something better presumably to make darn sure this is going to work.

MR. SCOTT: Observation of the results of the effort that we have taken so far suggests that we are bringing the issue to closure plant by plant. Can I guarantee you that no change will be needed in the plan to address two things, the remaining 23 plants whose test protocols were not together with the licensee on, and to address in-vessel effects. Can I guarantee you there will be no changes? No. We put what we believe to be a path forward to success in place. We'll see what the Commission directs us to do and we will move forward.

DR. KRESS: The panel that does the interval review of specific plants, do they have written guidance on what to look for and what to accept and what not to accept or is it just their judgment?

MR. SCOTT: We have process description that says how they do their job.

DR. KRESS: How?

MR. SCOTT: It does not contain a technical description of balance this against this, except to the extent that it says once you have compared the various uncertainties and conservatisms that apply to each licensee's case, has that licensee provided reasonable assurance that they're in compliance? If the answer is yes, then they accept it and we move on. If not, the plant gets RAI'd.

DR. KRESS: And how many plants has that been done for?

MR. SCOTT: Of the 40 -- well, it's been done at least at an iteration with all 69 PWRs. If your question is how many have been subjected to that process and reached closure through it --

DR. KRESS: That's what I'm asking.

MR. SCOTT: And by closure I mean agreement with the staff on their testing. Of the 46 that we consider to be at that point, probably, and this is a guess here, like two thirds or maybe more than that have been through the IRT process.

DR. KRESS: Has the ACRS reviewed this IRT process?

CHAIRMAN BANERJEE: Yes, we have.

DR. KRESS: Do you think it's all right?

CHAIRMAN BANERJEE: I think our letter endorses the process. We haven't reviewed instances of its applications recently and possibly at some point we will, but the process itself when it was first started we reviewed that.

MR. SCOTT: Okay.

MR. HOTT: This last bullet here, just to touch on this, we talked about some of the things that plants have done like increasing strainer size. Plants have also removed fibrous and particulate debris. Plants have changed some pH buffers. Some plants have installed debris interceptors. And some of those actions taken would be disabling the automatic initiation containment spray.

DR. KRESS: When they change the pH buffers, has anybody evaluated whether the new buffer has chemical effects with respect to GSI-191?

MR. SCOTT: The answer to that is yes. Whatever buffer that the licensee has gone to or plans to go to is submitted to us as part of the evaluation process for GSI-191 and gets reviewed.

DR. KRESS: Do you think we've done tests like they did on the other chemistry effects?

MR. SCOTT: There has been testing of all of the buffers that are in use in US PWRs.

DR. KRESS: With respect to blockage of filters?

MR. SCOTT: Well, with respect to the tendency to produce problematic precipitants, yes.

DR. KRESS: Okay, yes.

MR. SCOTT: Chemical effects.

DR. KRESS: Okay.

MR. HOTT: Some of this we just talked about, 33 of 69 PWRs have already performed their analysis in strainer testing using methods acceptable to the staff. And 13 more currently plan to do so.

DR. WALLIS: I'm puzzled. They were asked to do this some time ago?

MR. SCOTT: 2004.

DR. WALLIS: So -- I don't understand why six years later half of them haven't done it. It seems very peculiar. As a member of the public, rather than a consultant, what's holding it up?

MR. SCOTT: Degree of difficulty of the task in large part. Remember what Chris said in one of his slides a few minutes ago, that the strainers were made larger before the testing was done and the testing turned out to have significant challenges with it. For example, you can't test the system in the plant, obviously, so it has to be done in a prototype vendor facility. And it has turned out to be very challenging to have the vendor test facility adequately represent what goes on in the plant, particularly challenging for those plants that have attempted to credit debris settlement.

Staff is sure that some debris settlement would occur. The difficulty is showing how much would occur and not overstating it through a test.

DR. WALLIS: So six years ago you had a plan and a way forward, the way you do today and then it somehow or other turned out to be too challenging for half the plants six years later.

MR. RULAND: If I may, Dr. Wallis, the reason we're here today with this Commission paper is because staff had growing impatience with the industry and we attempted to issue the 50.54(f) letter. That was our plan.

DR. WALLIS: What does the 50.54(f) require?

MR. RULAND: The 50.54(f) letter -- and Mike actually has better recall on this than I do, but the 50.54(f) letters were asking licensees, requiring licensees to tell us how they were going to meet

GDC-191 with regard to some problematic information and testing. And that was the staff's way to get to the heart of the matter in as expeditious manner as we thought.

Since that, of course everybody knows, that the Commission asked us to wait on the matter and give them a paper. And that's why we're here.

DR. WALLIS: Of course, you might come back saying that your previous recommendation for those letters was, in fact, the right one.

MR. RULAND: Maybe they will.

DR. WALLIS: It's not off the table completely.

MR. SCOTT: Not at all.

DR. WALLIS: That's reassuring.

CHAIRMAN BANERJEE: Not off the table at all.

DR. KRESS: Are there differences in the designs of these filters in terms of materials and mesh sizes?

MR. SCOTT: I would say that the materials are not far different. The geometry, the structure of them varies significantly from designer to designer.

MR. HOTT: Most of the 23 remaining plants have large amounts of fibrous insulation.

DR. WALLIS: Could I ask you about that? If the fibrous insulation were taken out, would the problem go away?

MR. SCOTT: Probably. That's a GSI-191 answer. It probably would.

DR. WALLIS: All the problems of downstream and filter blockage and everything associated with fibrous insulation?

MR. SCOTT: Mostly.

DR. WALLIS: The blue jean dust and stuff, but that's --

CHAIRMAN BANERJEE: That's different.

DR. WALLIS: That's different.

MR. SCOTT: The real issue here is that it doesn't take much of the right kind of material to cause a significant head loss.

DR. WALLIS: We don't have to take it all out?

MR. SCOTT: Not necessarily. We have accepted the demonstration that several plants have made that I would not describe as low fiber plants, but some low fiber plants have seen significant head losses so if a low fiber plant uses a test protocol that we do not accept, it is difficult for us to conclude that that plant has adequately addressed the issue. We believe once that that low fiber plant does a task with the test protocol that we find acceptable, they will succeed. But if the question is can you just say okay, the fibrous insulation is gone, can we just walk away and the answer is no. We need to see a test and evaluation.

DR. WALLIS: Do you do a test with no fibers then?

MR. SCOTT: It has little fiber. The issue of course is that latent material typically contains fiber. So a plant, and particularly a plant that has already had fibrous insulation in it, even when they remove it, there will be some remaining. And it doesn't take much of the material to be a bad actor. At the end, the low fiber plants largely are done with this issue at this point, but it's an over simplification to say take away the fibrous insulation and you're done.

MR. HOTT: But it is true that fibrous insulation is a very problematic material for strainer performance and that's why many of these remaining plants have tried to credit tests and evaluation requirements to reduce those.

CHAIRMAN BANERJEE: So when you say most of the 23, how many actually are high fiber? Do you have a number?

MR. SCOTT: Not sitting in front of us. It is, in fact, most of them. But I can't -- over half, well over half.

CHAIRMAN BANERJEE: And the others simply are there because they haven't yet worked out a best protocol and agreed to do tests that the staff finds acceptable?

MR. SCOTT: There are a few cases where a plant has low fiber, but has, for example, credited debris settlement. There -- some of those cases, the plants have since decided well, you know, we're low fiber, we can probably succeed without crediting settlement, so we're going to do a new test and they're discussing the new test with the staff. There are those kind of situations, but the bulk of the plants that remain are those with a relatively large amount of fiber and they typically either credited the settlement which is referred to on this slide or the zone of influence reduction, which the staff has also not accepted. And I believe you all have seen a copy of our letter on that?

CHAIRMAN BANERJEE: Right.

MR. SCOTT: Most of them fall under those two issues that are on this slide.

CHAIRMAN BANERJEE: Of the 46 plants that would appear to be getting close to closure, how many of these were high fiber plants, any?

MR. SCOTT: Several of them, some of them were not low fiber. It's kind of high fiber, medium fiber, and they're not low fiber. Not plants with a small amount of fibrous insulation.

CHAIRMAN BANERJEE: So they have to remove fibrous insulation?

MR. SCOTT: Some have, some have not.

CHAIRMAN BANERJEE: Have some removed fibrous insulation?

MR. SCOTT: Yes.

CHAIRMAN BANERJEE: And were these sort of substantial removal of fibrous insulation like most of it?

MR. SCOTT: I would say in a few cases. I can think of one or two plants that either have or are planning to make major reductions in the amount of insulation, probably and quite a number of others have taken out discrete parts of their fibrous insulation, maybe not -- I wouldn't describe it as a full plant change out. As far as full plant change out, I can probably count those on my hand.

DR. WALLIS: Well, Mike, it seems to me

that if the rule were, if the guidelines were such that you want a success on this project, this GSI issue, within a short time, say one or two years, and you want a very high probability of success, then the only solution is to take out the fibrous insulation. Otherwise, you'll be asking for them to do tests for a long time, just the way they have or haven't for several years already.

MR. SCOTT: Okay, well, they all have done testing. Okay.

DR. WALLIS: But it doesn't seem to convince the staff that it's okay.

MR. SCOTT: Forty-six of 69, we've accepted their testing.

DR. WALLIS: But you see, my thesis is if you want to do it and you want a good chance of probability of success --

CHAIRMAN BANERJEE: I think we should put this question on the back burner and come back to it later because I guess that's the crux of the issue. Let's continue, otherwise we're going to run out of time.

DR. KRESS: If we could get back to that question, I'd like to know what the other side, the down side of that is. What's the problem with it?

MR. SCOTT: The downside is it is a -- as we will talk about it, as I'm sure NEI will talk about it in their presentation, to undertake a major insulation removal or replacement campaign, entails a significant radiation exposure to workers. And it's expensive. I mean it's a big money thing too for them. And there's a view expressed that it's not worth it.

DR. WALLIS: What's the cost to the public of not resolving the problem? There must be something on the other side?

MR. RULAND: The philosophy of the NRC staff in this matter is that licensees know their plants the best. For the NRC staff to basically a priori state all the insulation needs to come out, which we could have said and actually we had talked about probably four or five years ago, we basically concluded that we're not in a position to make that determination. Licensees are in the position to decide how best to comply with GSI-191.

DR. WALLIS: But if you're going to do sort of a cost-benefit analysis, there's got to be some cost assigned to not solving the problem. How do we balance that against the cost of removing the insulation or whatever it is?

MR. SCOTT: The staff intends the problem to be solved. As Bill Ruland said, we don't get prescriptive and say you have to do it a certain way. Clearly, to do what you said a minute ago, to undertake to remove all or most of the fibrous insulation will in all likelihood bring a plant to the finish line, once they have an acceptable test to show that that's adequate. But we're not in a position to direct them to do that.

You mentioned a couple of years, the time line is probably more like four years because it takes two refueling cycles.

DR. WALLIS: But what is the cost of not doing it? It seems to me that if there was some cost established for not complying, then the plant could make a rational decision about what to do to fix it. There's cost for not complying. There's no incentive. Let's proceed expeditiously with a solution.

MR. SCOTT: The staff intends that licensees will be in compliance. We have put a path forward to the Commission that proposes to take them there.

MR. RULAND: One of the key advantages that the staff sees about taking this issue to the Commission is the Commission will make a policy decision on this matter and if their policy decision is licensees remove all the insulation. That's the policy decision and we'll go forward. If they say 50.54(f) letters, that's what we'll do.

From our perspective, that's the biggest -- that's a really big advantage of doing the SECY paper. We put this issue before the decision makers, the policy makers of this Agency, and we let them make the policy decisions and we'll implement them.

DR. KRESS: This is not in backfit space because it's a compliance issue. So you don't have to make these arguments about the costs. You make them, but they're not really part of the decision.

MR. SCOTT: It is not our decision on whether or not the plants need to comply. They need to comply.

DR. KRESS: Yes.

MR. SCOTT: This fall s under --

DR. KRESS: It's their decision on how to comply.

MR. SCOTT: Correct.

DR. KRESS: And all you have to do is say yes or no, you're in compliance.

MR. SCOTT: Correct. The tricky part is getting to that.

DR. WALLIS: But there's no cost for not complying. This can drag on for years. You said four more years.

DR. KRESS: Well, you'll give them a time line eventually.

MEMBER SHACK: Let them get to their options.

MR. SCOTT: We will do what the Commission directs us to do.

DR. WALLIS: I'll leave you, but I'm just trying to get you to face a rational way of making a decision on this thing before we get into all the details which I think we all know about already. But anyway, I'll let you go ahead.

CHAIRMAN BANERJEE: We are still getting some background. Let's move through this quickly and get to the options. Because that's really --

MR. SCOTT: I think we're pretty much done with the slide, aren't we, Chris?

MR. HOTT: I think we are.

CHAIRMAN BANERJEE: I expect that everybody here has already read the SECY and all enclosures, so you can go fast.

MR. SCOTT: Theoretically, yes.

(Laughter.)

CHAIRMAN BANERJEE: I know nothing goes fast in front of the ACRS.

DR. WALLIS: Let me ask about the last line, "industry planning new efforts." Do you have a schedule for that?

MR. SCOTT: We have been provided a schedule for it. I believe that the current campaign that they are proposing would end up with issuance to us or submittal to us of a -- I guess a topical report and a staff review of that to be concluded by the end of next calendar year.

DR. KRESS: You haven't ruled out changes to the zone of influence mechanism?

MR. SCOTT: I'm sorry, I thought that's what you were talking about, Dr. Wallis. That's why I'm referring --

DR. WALLIS: I'm asking when it will be done?

MR. SCOTT: Let me speak to them separately. The settling discussion is going on now. We have had over the last three months we've had about a better part of a half dozen meetings with the vendor involved. I would think that by the end of this year, we would have significant clarity on whether we're going to accept a test protocol that accepts or credits settling or not.

The deadline I was referring to a minute ago regarding the end of next year is for additional jet-impingement testing that the owners' group plans to support what they believe to be reasonable reductions in ZOI.

DR. WALLIS: So that will be completed by then?

MR. SCOTT: That's their expectation, yes. The staff has no current strong view as to whether they're going to succeed or not. We haven't seen the submittal, of course. We haven't seen the testing. The staff does not believe that the current ZOIs are necessarily overly conservative, but the industry believes they are and is planning to attempt to show that they are. We'll see how it goes.

MR. HOTT: Next slide. I'll skip down here to the second bullet and note here that the industry expressed concerns regarding dose costs and lack of safety benefit during the April 15 Commission meeting and that the industry preferred path forward was leak-before-break credit for sump evaluations. We also got some stakeholder input from the Union of Concerned Scientists, two letters, one on April 14th and another on April 26th, basically that said -- the first letter said that they thought that staff was on track to successfully close out and the second was support leak-before-break under certain circumstances.

CHAIRMAN BANERJEE: Could you expand on the second letter a little bit, what that aspect was, just briefly?

MR. HOTT: Yes, the letter said that the Union of Concerned Scientists would support LBB if the leakage detection systems were of high enough fidelity to ensure that plants would detect a leak and take action, if they actually had a leak. The concept of leak-before-break, they would identify it, take action to shut down the plant safely.

And another aspect was that no changes made for GSI-191 such as debris interceptors would cause a location in the plant that would cause water to hold up in a way that wouldn't be available for sump recirculation.

Next slide.

MR. SCOTT: I think they've already seen this one. We can zip right through this. This is what the SRM said. You've all seen it.

DR. KRESS: Does leak-before-break exclude the same size pipes as the new definition of large break LOCA threshold or are those different sizes?

MR. HOTT: Those are potentially different sizes.

DR. KRESS: Do you get lower relief with leak-before-break?

MR. HOTT: You can. Next slide. We have had several interactions. We've had correspondence from NEI and as I mentioned Union of Concerned Scientists. We've also had meetings to make sure we understand all of our stakeholders' viewpoints. We've reconsidered leak-before-break and have new information since the last time we evaluated it in 2004.

We also considered how we might utilize risk information or risk-inform the solution.

DR. WALLIS: I'm puzzled by that. When I read your documents and you say you can't predict what will happen with these filters and downstream effects and so on, so how can you predict the risk if you can't predict the consequences of the various phenomena. If you can't predict the outcomes of whether or not the system is cold or not, how can you risk-inform?

MR. SCOTT: There are great challenges to that for this issue and we will talk about those. If you can hold that until one of the later presentations today.

DR. KRESS: I assumed that applied strictly to the change in large break LOCA threshold. Am I wrong in that?

MR. SCOTT: Well --

DR. KRESS: You can easily do a risk because it's strictly frequency effect on CDF.

MR. HOTT: Right, if you assume some fails, then that would be certainly a bounding way to look at that.

MR. SCOTT: And that is part of the discussion that we'll have this afternoon.

MR. HOTT: Evaluated dose impacts were sensitive to occupational doses as we've discussed before, that might be incurred from insulation change out. So we did a limited survey to try and evaluate what sorts of doses plants might get from change outs.

When we evaluated the SRM, we had focus groups who were evaluating each of the potential issues. We tried to think of some new innovative approaches and lastly, we considered separating end-vessel effects into its own generic issue.

Next slide.

Having considered a number of options, we narrowed the list down to three, two of which have sub-options. The first option is to continue the staff's current approach which involves extensive plant-specific interactions and ends in a holistic review of some performance way overly conservative staff determinations.

In the sub-options to this option 1, involve whether the NRC should establish firm schedules for issue resolution or not.

The second option involves a new effort to provide a risk-informed approach to GSI-191 for larger, less likely LOCAs and then the risk-informed aspect is based on the lower initiating event frequency for the large breaks.

DR. KRESS: You would resolve the issue for the small breaks first and then do the large breaks later, I'm having trouble deciding on what those time frames are going to be, what basis you'll use to establish the actual time frame.

MR. SCOTT: What was decided or what's proposed in the SECY paper is that the small breaks, smaller breaks, I should say, are not likely to be helped by the risk-informing aspect and we should be able to proceed with resolution of those, basically restart the process that's been somewhat in abeyance for the last several months.

For the large breaks that would be potentially affected or assisted by the risk informing, the staff has proposed to allow time for either issuance of 50.46(a) if the Commission decides to do that or to develop implementation guidance for existing risk-informed regulatory framework for GSI-191. So that would add, we assume, a year from whatever the Commission decision date is on 50.46(a).

So if you look at it, small breaks, you're talking two refueling cycles out. Why? Because the licensee would need to potentially run another test without crediting settlement, for example, or crediting DOI reductions. I mean if that's the way the Commission goes with it. Then they would be running testing and then they would take the results of that and plan to do modifications. And it takes two cycles to do these modifications because they need to walk down the systems in their first refueling outage, order the materials and so on and then actually install the second refueling cycle.

Now if the Commission decides that additional time is warranted to wait, for example, for the next attempt at ZOI reduction to run its course, then that would add potentially another year or more.

So depending on how the Commission comes down on how much more time for refinements, and how much time are we going to bifurcate the process for different risk categories, it could be -- there could be variations of a matter of a year or two either way.

DR. KRESS: Let me ask you a question about settling. I know it's a different issue. It looked to me like when they take credit for settling, it's for sizes that are bigger than some thresholds because those are never transported to the filters. It seemed to me like those sizes wouldn't be much of an issue anyway if they got to the filter.

MR. SCOTT: Indeed, the material, the debris that is most challenging for the strainers is the finest debris which is also the debris, obviously, that is most inclined to transport and least inclined to settle, but some of the testing that has occurred that has credited settlement, a large amount of the fine material settles.

DR. KRESS: That I didn't know.

MR. SCOTT: And so the question is would that happen in the plant?

DR. KRESS: Yes.

MR. SCOTT: And the staff has to date not been satisfied that a demonstration has been made that

that would occur in the plant as well.

DR. WALLIS: This is with respect to the turbulence.

MR. SCOTT: That's one factor. There are a number of them. It's trying to show that your relatively small narrow vendor flume test facility is representative of a relatively large complex PWR sump environment, floor environment is not a simple exercise. And the licensees that have attempted to go that direction have done so because they're concerned about it's going to show an excessive amount of material getting into their strainer. But they have, in order to attempt to avoid having to take that penalty, if you will, they have elected to go down a very complex path and we're not where we are today with regard to settlement from lack of meetings. We've had dozens of meetings on this subject with the industry over the last several years and they've not yet reached fruition, but the industry is attempting to work with us to come up with a settlement protocol that we would accept. And we're still in the throes of trying to get through that.

DR. KRESS: Is there an optimum amount of material?

MR. SCOTT: Yes, that which you can

justify.

DR. KRESS: For example, a certain amount of material would lead you up too close to the net positive suction head probably, but it would stop material from going in vessel and reduce the amount of probable in-vessel. So it would seem to me like there might be an optimal. We may have put too much filter space in that.

MR. SCOTT: Thank you for stating why the staff does not want to separate the in-vessel effects issue from the sump strainer issue.

DR. KRESS: That's a good idea, I think. They are related.

MR. SCOTT: They are related and it is true that making strainers bigger potentially causes more material to go downstream. So to try to separate the two issues, we don't think is an appropriate thing to do.

MEMBER ABDEL-KHALIK: If one is not going to separate the downstream effects, would option 2 then make any sense?

MR. SCOTT: Well, the way the downstream effects thing appears to be going to play out, I won't offer Dr. Wallis a guarantee, but the way it appears to be going to play out is if you've read about the cross test that we have asked the licensees to do, that is to happen this Friday. There will be probably one more test and if it doesn't have surprising results, that being a low-flow test, then the testing campaign from our perspective would be complete. We would be prepared again to come to you in October to talk about where that goes and then we would plan to issue a safety evaluation near the end of the year.

So the in-vessel time line fits with the rest of this unless something new comes up in one field or the other.

CHAIRMAN BANERJEE: But the indications preview, if you like, is that if tests go the way that you hope or expect they will go, that this in-vessel effect would be dealt with without having to make additional changes?

MR. SCOTT: What the owners' group tells us is that -- and when the industry makes their presentation, maybe they'll have a different view on this. We don't have a submittal on it, but we understand that most of the PWRs are bounded by what's proposed in the topical report. Those that are not will have to decide on what they're going to do, either remove materials or do their own testing. I struggle to imagine they would do their own testing because what they would do that would be different from what the owner's group is doing is not real clear, but I suppose possible.

So some fraction of the plants and I don't have an exact number because we don't have a submittal on it today, some fraction of the plants could even if they're among the 46 that are shown as okay, it is possible that the in-vessel effects issue could lead them to do additional modifications. They will have, I believe, very high visibility on the need for that this year because this in-vessel thing, as I indicated, is coming to a close.

DR. WALLIS: Are we going to see how it comes to a close because the last stuff we saw was somewhat confusing.

MR. SCOTT: October 22, 2010, the staff will be briefing this Subcommittee on the in-vessel effects topical report and its safety evaluation.

DR. WALLIS: And that's going to resolve the issues that we had with the last one?

MR. SCOTT: I can't say whether it will resolve all issues that you have. We believe that a defensible test program has been conducted. We have pushed for a substantial amount beyond what the owner's group originally proposed. There have been some interesting and challenging results from that testing. We benefitted greatly from the Commission's advice on this subject back in 2008. And we're a long way from where we were in 2008. We believe that the industry has done an adequate job addressing this issue. We'll see what you all say.

CHAIRMAN BANERJEE: The only issue here would be that you know selecting between these options might be better once we have that in-vessel information.

MR. SCOTT: Well, you will have whatever we have --

CHAIRMAN BANERJEE: In October.

MR. SCOTT: We plan to issue the draft safety evaluation this month.

CHAIRMAN BANERJEE: Okay.

MR. SCOTT: And we'll provide it to the Committee at that time. Now those two tests that I talked about, the low flow test and the cross tests are only now occurring so the write up on those is going to be a little bit later. But you'll have 98 percent of that safety evaluation, you'll have it this month, but I guess you probably won't have time to review that and have it affect your letter which I believe you intend to send to the Commission before the briefing which is September 29th. So --

CHAIRMAN BANERJEE: We won't have the benefit of that information. You have the benefit of that information, but we don't.

MR. SCOTT: Again, we see the way this in-vessel thing is playing out now, is supportive of the options and the recommendations that the staff has made to the Commission, because again, we see this as a wrap up by the end of this year on the in-vessel issue. The other, if we -- if the Commission authorizes us to go the 50.54(f) letter route, then we're going to be sending letters to licensees and asking for 60-day or 90-day turnarounds on responses and before you know it, we're out in 2011. So again, I think the time line kind of falls together reasonably well, subject to unexpected developments which is the history of this issue.

MEMBER ABDEL-KHALIK: A general statement that one can make is that absent a clear and timely resolution of the in-vessel effects issue, segregation time-wise, according to option 2 would not really make much sense.

MR. SCOTT: It might not. Even with that issue resolved, it might or might not be useful to the licensees. If you think about it, first of all, we don't know if they get substantial benefit from large breaks, but the small breaks remain, how much help that's going to be to them. And they may not like the possibility of a more complex resolution framework where you, okay, we resolve this portion of the breaks, but not this portion. They may not choose to go there and that would be their call.

What we're trying to do is be flexible here and offer an opportunity to risk-inform the solution and the time line if the licensees wish to do it and the Commission accepts it. We're trying to be flexibility, but this may not help them all that much.

CHAIRMAN BANERJEE: You might two sets of testing.

MR. SCOTT: Possibly.

MEMBER ABDEL-KHALIK: But then the reason why I repeated that point is that that issue is not sort of clearly stated in your response to the Commission.

MR. SCOTT: What we stated was that it should not be broken out as a separate issue and that we would resolve it with the rest. We did not get into details, a lot of detail about the interplay between it and the other. As a matter of fact, I think we did have a discussion of it and we talked about our expectation for the time farmer of its resolution.

MEMBER ABDEL-KHALIK: The point is the time line for resolving the downstream effects has to be shorter than either of the two time lines for either small break LOCA or large break LOCA in order for option 2 to make any sense.

MR. SCOTT: And in all likelihood it will be a shorter time frame.

CHAIRMAN BANERJEE: I guess that's a point we can discuss, if we wish to.

MEMBER ABDEL-KHALIK: Right.

CHAIRMAN BANERJEE: It's clear that the downstream effects could affect the option you want to choose here and in some sense while you discussed downstream effects and fairly well, the interaction between resolution of the downstream effects and the selection of one of these options is not as Said says, thought out, if any.

Now we have to determine if there is an effect, interaction or not. But --

MR. SCOTT: There clearly is an interaction because you need to resolve the issues together. So -- that is our view. But they need to be resolved together.

So as long as the in-vessel effects issue comes to closure early in 2011 as we currently anticipate it will, then that's not going to slow this process up or affect whether you bifurcate it between long and -- small and large breaks. But it's possible that if it gets delayed, it could affect that.

CHAIRMAN BANERJEE: Okay, anyway, let's continue. I think we understand what these options are.

MR. HOTT: All right.

MR. SCOTT: Did you talk about option 3?

MR. HOTT: Option 3 is to allow application of leak-before-break to sump evaluations.

CHAIRMAN BANERJEE: You're going to expand on that later on?

MR. HOTT: Yes.

DR. WALLIS: That wouldn't make all the other things go away. That would just -- you'd still have to retain thoughts of option 1 if you allow LBB.

MR. HOTT: For plants, for piping that's not LBB qualified, you would still have to analyze --

DR. WALLIS: It doesn't make the problem go away just because you accept LBB. You still have to show that you comply.

MR. SCOTT: Yes, but now, let's -- there

are some, I guess, scenarios where a plant has had a test that we considered the debris generation to be non-conservative and now they show through leak-before-break that their debris generation that they happened to have tested before was conservative, if you took all that debris out of the equation and that could be done. Depending on what their new limiting break is.

DR. WALLIS: They would have had essentially to have done option 1 already and LBB just sort of cuts off part of it and makes it work. They would have had to done option 1 though.

MR. SCOTT: They have to make a compliance demonstration.

DR. KRESS: It seems to me like the sub-bullet under the third bullet, 10 CFR 50.46, rests on some of the technical bases as option on the leak-before-break.

MR. SCOTT: We'll talk about the differences.

DR. KRESS: There are differences?

MR. SCOTT: There are differences.

DR. KRESS: Other than the pipe size, there are differences?

MR. SCOTT: There are substantial

differences. Trust me, we will talk about those.

DR. KRESS: Okay.

MR. HOTT: All right, the staff is recommending a combination of options 1 and 2 with a risk-informed resolution schedule. Part of that would be revisiting risk tools for the larger, less likely breaks and option 3 is not recommended for reasons discussed in the next presentation.

Next slide.

Despite the fact that loss-of-coolant accidents are low probability, especially large breaks, the staff still believes GSI-191 is a safety issue. Inability of sumps to pass adequate flow is a high consequence of that, likely leading to core damage and loss of mitigation system, containment spray. And we've seen in some plants LOCAs as small as three inches and generate enough debris to challenge the sump performance.

DR. WALLIS: You're saying it is a safety issue or is not?

MR. HOTT: It is. It is still a safety issue.

CHAIRMAN BANERJEE: They've answered the question by saying yes, it is.

DR. WALLIS: How much of a safety issue is it?

MR. SCOTT: It is sufficient concern to us that we believe it is imprudent to continue indefinitely without resolving it. At the same time for reasons --

DR. WALLIS: How prudent is it to let it go on?

CHAIRMAN BANERJEE: The strainer is bigger.

MR. SCOTT: We've stated the reasons and they're restated in the SECY paper why we believe it is acceptable to continue operate while the issue is resolved. At the same time, we have proposed a clear path forward to get to closure in a reasonable period of time.

DR. WALLIS: There's no cost to the plant for having a safety issue unresolved. That's what puzzles me.

MR. RULAND: If I could add something about that? Typically, when we bring these -- when licensees talk about costs, a number of licensing managers in these kinds of circumstances will say to us that having this issue before them year after year diverts their management from focusing on other issues that they believe are important, some of which are safety issues.

And you can ask the industry when they come up whether or not they believe that's the case, but they have made those statements to us in similar circumstances about this whole notion of resolving the issues.

The licensees now have placed in the NRC's court the whole idea of cumulative impact of regulatory requirement. A number of NRC-mandated requirements are out there and licensees, frankly, are required to juggle them all and this issue, amongst others is just another thing on their plate. There is a benefit and I would argue a safety benefit to have licensees focus on a few issues it wants. That is another factor.

I don't want to speak for the industry. You can ask them.

DR. KRESS: Are large break LOCAs frequencies, 10^{-6}, 10^{-7} per year? As best I recall. My memory may be hazy on that because it's been a while.

MR. SCOTT: I think it's less than 10^{-6}, but we probably have a staff person who can speak to it accurately. Here comes --

MR. DINSMORE: Steve Dinsmore from the NRR

PRA Branch. The TBS LOCA which is kind of what we're looking to find in large break, it was selected so that we were confident that the frequency of that break was 10^{-5} per year or less.

DR. KRESS: Okay, 10^{-5}, that makes a difference. I was assuming 10^{-6}.

MEMBER ABDEL-KHALIK: But this is the positional break size.

DR. KRESS: If you used the 10^{-6} and set it all with the CDF, well, without any other consideration, then that's an insignificant increase in the CDF of the plant.

MR. SCOTT: We have issues anyhow which we'll talk about as to why we don't think that's a prudent way to make a regulatory decision.

DR. KRESS: Is it defense-in-depth?

MR. SCOTT: That's a large part of it, yes.

DR. KRESS: I can see that.

MR. SCOTT: The fact that Chris already talked about it, the second bullet on here. This is a situation where if you adopt leak-before-break and we're getting ahead of ourselves here, if you adopt leak-before-break and you assume that if you were to get a LOCA in an LBB pipe, you've got to assume some failure because you have no demonstration of sump adequacy and therefore you lose ECCS and you lose containment spray which we do not believe is a good state of affairs to have, regardless of the probability where you lose both the preventer and the mitigator at the same time.

DR. KRESS: This is one of those cases where defense-in-depth overrides risk.

MR. SCOTT: Well, we are trying to risk-inform the process in the time line that we're proposing to allow and in the compliance demonstration which is what 50.46(a) allows some relaxation there, so we're trying to recognize the staff's current viewpoint on risk-informing the ECCS regulation, so I wouldn't say it's as simple to say we're not paying attention to that.

DR. KRESS: It seems okay, to do it for a time line because it's a limited amount that you're at this kind of risk. That makes some sense.

CHAIRMAN BANERJEE: Can I ask the question of the three-inch? Is that with the new sumps, the larger sumps?

MR. SCOTT: This is a plant that has one of the smaller sumps, but yes, it has a larger sump than it used to have. This is a product of the thin-bed effect.

CHAIRMAN BANERJEE: Okay. All right.

MR. SCOTT: This is why any argument that you hear about it's not a safety issue because large breaks are unlikely. We do not believe is a complete argument.

CHAIRMAN BANERJEE: Carry on.

MR. HOTT: This slide is about models and staff believes they're conservative, but not overly so and the industry believes they're overly conservative and that's why they're proposing new refinements and new testing.

CHAIRMAN BANERJEE: There's been a huge amount of work with this Committee. Actually, I've been looking down on ZOI, based -- you go back ten years. And I think they came to the firm conclusion that you could neither say it was conservative or not conservative. And there are enormous amounts of paper using all sorts of things.

MR. SCOTT: There is conflicting information out there today. We've had some international technical exchanges and heard references to higher ZOIs.

CHAIRMAN BANERJEE: Yes.

MR. SCOTT: So it is -- we haven't seen

enough to be compelling to conclude that our ZOIs as currently in the safety evaluation are non-conservative, but there is -- I agree with you, there's a lot of uncertainty out there about whether it is difficult for us to conclude and agree with the industry that what we have now is --

CHAIRMAN BANERJEE: I've actually just been looking through this as a matter of interest and it's opening a huge can of worms on something which is more or less agreed to right now and it could go any way. It's a wild card.

DR. KRESS: It would seem imprudent for the staff --

CHAIRMAN BANERJEE: Very, very imprudent.

DR. KRESS: To decide whether or not this is really conservative or not.

MR. SCOTT: Well, again, we believe based on the available information that the ZOIs in the safety evaluation are adequately conservative.

DR. KRESS: Wouldn't that be a plant-specific determination though?

MR. SCOTT: It's a material-specific determination.

DR. KRESS: Material and plant, it seems to me like. Because it depends on the --

CHAIRMAN BANERJEE: The geometry.

DR. KRESS: The geometry and where the material is compared to how you assume the sphere.

MR. SCOTT: That discussion was held quite some time ago in development of the 2004 NEI guidance on this subject. There are arguments pro and con regarding the simplification that the spherical ZOI represents and arguments whether its removal would result in a higher or a lower amount of material impacted.

Again, based on the information available to us today, we find the 2004 safety evaluation ZOIs acceptable and if information is presented to us that causes to revisit that, we'll revisit it.

The industry is attempting to revisit it from the perspective of showing that they're too large, and if a credible case can be made to support that, then --

CHAIRMAN BANERJEE: This is going to be extremely difficult argument to make based on scaling and similarity. I cannot see how you can do full-scale tests. I mean we are not in the situation where there is some regulatory certainty at the moment. I imagine if this issue came in front of this Committee, there would be very, very serious issues raised with it being conservative enough, perhaps, so because of the scaling arguments.

MR. SCOTT: And of course, scaling was a major issue that we had with the previous attempt at reducing ZOIs.

It is true that the industry in attempting to credit reduced ZOIs is swimming upstream because of all of those uncertainties --

CHAIRMAN BANERJEE: Trying to go up Niagara Falls?

DR. WALLIS: I like what you said, Mike. You're discussion was very good, but I think you ought to be careful about using the word "belief" here. Because if you believe something which is contrary to what the ACRS says, then it's not a very good thing to believe.

MR. SCOTT: What are you --

(Laughter.)

DR. WALLIS: About believing --

MR. SCOTT: Which particular belief are you referring to?

CHAIRMAN BANERJEE: The second bullet.

DR. WALLIS: It only applies to the top part, not the bottom part. You don't believe the ZOI, but you believe the debris generated in the transport part.

DR. KRESS: Well that ZOI, the debris generated.

DR. WALLIS: Would you believe that ZOI is conservative?

MR. SCOTT: I'm not sure what you're referring to.

CHAIRMAN BANERJEE: I think we take the fifth amendment and carry on.

(Laughter.)

DR. WALLIS: ACRS is very careful not use the word belief in any of its letters.

DR. KRESS: Because they don't believe in anything.

DR. WALLIS: High probabilities and things like that.

CHAIRMAN BANERJEE: Next slide.

MR. HOTT: All right. The purpose of this slide is really just to show that one way to consider all of these options in the SECY papers is to think of them in terms of requirements of relaxation. Option 1 provides no refinements of relaxations to currently accepted methods.

Option 2 would give refinements or allow them for larger breaks due to their low likelihood.

And Option 3 would provide the largest refinement in that no debris would be assumed to be generated in the debris generation --

DR. WALLIS: You've set schedules before and you've allowed some time. Are you going to do it again? Some time has got to be a deadline maybe?

MR. SCOTT: And we look forward to the Commission's decision on what that deadline will be based on the staff's recommendations or whatever course they choose to take.

Next slide.

MR. HOTT: We talked about earlier, we're sensitive to the potential dose impacts of additional modifications to resolve GSI-191. This shows the industry estimates during the April 15th Commission meeting which we're 600 REM for a maximum and an average of 200 REM per plant for fibrous insulation.

DR. KRESS: Is this per person?

MR. HOTT: That's collective dose.

DR. KRESS: Collective dose? It doesn't seem like very much.

DR. WALLIS: If you put enough people in there --

MR. SCOTT: Let's just -- why don't we leave the numbers here as they are and you can ask the industry about those when they make their presentation.

MR. HOTT: Seeing those numbers, we thought that those numbers were actually rather high, so we obtained some data samples from plants that we had known to have done insulation change outs and doses that we saw range from 5 to 44 REM, personal REM, an average of 19 personal REM.

MEMBER RYAN: But you've got to factor between the industry estimates as you said in the first bullet and your actual data which is an average of about 20.

MR. SCOTT: But look at the next bullet. We're not contending that these partial insulation replacements are representative.

MEMBER RYAN: What I want to ask you is what's the average of 19, based on 1 plant, 10 plants? You say it's data. It's not estimates.

CHAIRMAN BANERJEE: How many estimates. If they put it down, I think it's what, seven or eight plants?

MR. SCOTT: In that vicinity, yes.

MEMBER RYAN: Seven or eight plants, average 19 rev.

MR. SCOTT: For limited scope insulation

replacements. But what I don't want to do here is try to imply that those were full scope where a plant needs to take out all the insulation. That's why --

MEMBER RYAN: So how much more work would it take to go from the scope you saw to a full scope? Is it a factor of 10, 5, 2?

MR. SCOTT: It's plant specific. The industry's position has been that doing as we had proposed in our 50.40(f) letters would largely result in the remaining plants having to remove all of their fibrous insulation. We don't believe that's necessarily the case.

MEMBER RYAN: My question is what do you think a range in ultimate doses would be for real plants?

MR. SCOTT: I'm a bit reluctant to speculate.

MEMBER RYAN: Okay, I guess it would be a helpful insight to understand what that commitment is, across the range and it's good that you get the data for seven plants.

MR. SCOTT: We believe that 600 REM is overstated.

MEMBER RYAN: By how much?

MR. SCOTT: The 200 might be more like a

worst case. That's speculation --

MEMBER RYAN: That's fine. But that's your insight based on what you evaluated and seen so far.

MR. RULAND: We have had some informal feedback, unsolicited from at least one licensee that these numbers were overstated.

DR. WALLIS: Are there ways to improve the way in which you remove insulation, develop better robots or something or better devices to make it happen?

MR. SCOTT: All licensees do ALARA planning for jobs like this. This would not be one that they would have to rush into. So I think I basically agree with what you're suggesting, that the licensees could take measures to minimize this dose, but you are talking about, for example, some of these heat exchangers or crunch wraps and there's no getting around it. If they have to remove the insulation around the heat exchanger, it's going to be a significant dose. It's aggravated if they happen to have asbestos. Most apparently don't, but if they do have it and they have to remove that, then that would add significantly to their dose.

We know of one plant that is trying to

remove everything except an installation of that material, asbestos, on a heat exchanger that's particularly problematic, and their expectation is that they'll succeed in showing adequate strain of performance without taking that particular material out.

So again, it's plant specific. The last data point is to speak -- the last bullet on this page is to speak to the way it was portrayed in April was -- tended to be -- it's all or nothing. We've got to take it all out and we don't believe that's necessarily the case.

CHAIRMAN BANERJEE: Is it possible to protect it?

MR. HOTT: Yes, you can reinforce the insulation and that's an option that some licensees could choose. Also, there may be some of this problematic insulation that isn't within the zone of influence that they wouldn't have to replace.

MR. SCOTT: Yes, band it. They can band it.

MEMBER RYAN: I mean that's a big swing in what the ALARA cross would be, the duty -- it would be interesting to sharpen the pencil on some of that.

CHAIRMAN BANERJEE: Mike, this is, I think a line of questioning we need to follow --

MEMBER RYAN: Yes, thank you.

CHAIRMAN BANERJEE: What makes them think it would be 200 to 600 --

MEMBER RYAN: Fair enough.

MEMBER SHACK: You've accepted the banding? You have a value that you'll believe, the banding.

MR. SCOTT: The staff has issued for comment a draft revision to the 2004 safety evaluation that contains a proposed ZOI for banded material. There actually is something in the 2004 SAE, but we believe it needed some revision. So it's out there for comment right now.

CHAIRMAN BANERJEE: How much of a problem is latent debris? Because we've been looking at this for some of the new plants. And even for very clean plants they start to have significant downstream effects. And for the existing plants that you brought now, what sort of a problem was this latent debris?

MR. SCOTT: For the existing plants, it is possible that with latent debris alone a thin bed on the strainer could be incurred.

CHAIRMAN BANERJEE: Or it is a downstream effect.

MR. SCOTT: Right and if the bed does not incur, by and large the material goes downstream. The industry has done -- well goes downstream, settles, whatever. Industry has done testing. This is the in-vessel effects testing on both vendors' fuels and have established a limit or are establishing a limit since the testing is still going on that a low-fiber plant should be able to meet.

Now in the case of one of the vendors which has a lower apparent tolerance the other vendor, it is possible that some of their licensees could, even if they're not low-fiber plants need to go to low fiber to prevent having a problem in in-vessel effects. I'm not sure if that's the question you asked?

CHAIRMAN BANERJEE: I was more focused on latent debris in the sense that even if you have a low-fiber plant or a very low-fiber, no-fiber plant, is there still a downstream effect problem due to latent debris?

MR. SCOTT: It is likely that they would not have a problem. They would need to use the topical report to show that which provides them an acceptance criteria in terms of the amount of debris that bypasses the strainer. And if they are able to show they're bound by the topical report and the NRC accepts the topic report, then they're good to go. If not, then they have to consider path forward.

MR. RULAND: Mike, could you talk just a little bit about why licensees specifically don't want to reduce the latent debris term.

MR. SCOTT: I'm not sure what you mean.

MR. RULAND: For instance, 200 pounds latent --

MR. SCOTT: Oh, okay. Licensees want to retain margin for either new modifications or unexpected developments. So for example, you come up with the latent debris amount in your plant by sampling over outages. And let's say you get 50 pounds which is not an unheard of number. A licensee might assume in their testing 200 pounds or use that much in their testing, simply so that if somebody goes out in the next cycle, they have 80 pounds of latent, then there's no problem. Or if they want to do a modification, for some reason they want to put some fibrous insulation in the plant, and in this day and age you wouldn't want to do that if you could avoid it, clearly, because of this issue, but if you had to, they'd want to be within their analysis limits.

So I think that's what Bill was referring to. So some of them want to assume more than they actually have. So in some of these cases, we've actually had a situation where if the plant tested with the amount of fiber they really have, latent fiber, we'd be pretty much sure they'd be fine. But the problem is they tested with a lot more and it's so -- okay, so they really have 50 and they tested with 200. Would we be okay if we found they had 150, if we didn't accept the test that yielded or resulted in 2000? That puts us and them in a difficult situation. I see the low-fiber plants going around with this.

CHAIRMAN BANERJEE: So are there sort of typically samples taken during outages and things to keep an eye on the latest debris?

MR. SCOTT: There is guidance out there in the safety evaluation from 2004 on how to sample and how often to sample and the licensees do that. And that's one of the areas we review in their packages.

MR. HOTT: Next slide. And we've covered everything on this slide, I believe. Go to the next one.

This slide is to just highlight some of the advantages of the recommended approach. We believe that the interim resolution for the most significant more likely small break LOCAs while allowing additional time for industry to justify some evaluation refinements to maintain sufficient defense-in-depth by requiring mitigation for all size breaks incorporates risk insights both in the implementation schedule and in the analysis of large or less likely LOCAs. It continues the holistic review process that's been successful for two thirds of all PWRs and it balances known conservatisms against uncertainties to avoid excess conservatisms.

An implementation schedule here also takes into account the amount of effort and planning necessary for licensees to plan and execute those additional modifications using ALARA methods to reduce the radiation --

DR. WALLIS: There's not a danger of the staff not requiring enough conservatism? You seem to be worried about acquiring excess.

MR. SCOTT: We are pursuing an approach that we believe would provide adequate conservatism. The real problem here that the industry has expressed and I'll answer your question kind of indirectly here. There are a number of review areas, better part of a dozen review areas, debris generation, debris transport, MPSH, so on and so on and so on. And the staff has, through the 2004 safety evaluation, determined that there is an adequately conservative approach to each of those areas.

The problem that the industry has expressed is since it's basically a multiplier here in figuring how much gets to the strainer and what happens when it gets there, that if you're conservative in each area, you're potentially grossly over conservative by the endpoint when you're calculating the actual strain of performance.

So their view is that we are inclined to have over the process of resolution of this issue, push for more conservatism than is needed. We put this IRT process in place to get away from that, but the IR is charted to still have assurance that the licensee has shown compliance. So we believe that there is adequate conservatism in the approach that's taken.

The IRT has not been successful in reaching closure for licensees when they have large number of open questions regarding their methods. So once the licensee has whittled down the number of questions that the staff has to a very few and you compare that with the demonstrably significant number of conservatisms that are involved in using the approach that the staff has accepted, that we can say okay, so there's this one remaining item that we had some questions about, but overall, the staff concludes that the issue has been addressed conservatively and then we sign off on the plant.

So we believe that that process provides adequate conservatism.

DR. KRESS: On your third bullet, in a previous slide from the Committee, I had trouble with deciding how to measure defense-in-depth and put a number on how much was sufficient.

Do you have any help for me on that?

(Laughter.)

I never could decide how much was sufficient or how --

MR. SCOTT: Can I take the fifth on that, Dr. Banerjee?

CHAIRMAN BANERJEE: Go ahead.

MR. SCOTT: The point of this bullet was to contrast the defense-in-depth situation with LBB versus the defense-in-depth situation with 50.46(a) --

DR. KRESS: That's probably a good way around the issue.

MR. SCOTT: In the one case a demonstration is required to show that the strainer could handle that particular break. And in the other case, it's not. So that's one of those things wherein our minds it is -- there's a clear demarcation here of what's good enough and what's not. Beyond that, I probably have to pass.

CHAIRMAN BANERJEE: I think clearly we should continue -- this question is not going to get answered quickly. Mike Corradini is on the line and would like to ask a question. Can you hear us?

MEMBER CORRADINI: I can hear you Sanjoy. How do you know that I want to ask a question?

CHAIRMAN BANERJEE: Because I have second sight.

(Laughter.)

Carry on.

MEMBER CORRADINI: Well, my question, it was a while ago and I didn't want to bother folks.

Are we going to come back to the risk-informed approach? That's maybe a general question. If we are, I'm going to hold my question until we come back to it in the next presentation. Is that correct? We're going to see this again?

MR. SCOTT: Yes, we have a follow-on presentation on this.

MEMBER CORRADINI: Then let me hold my question because it was back about two or three slides ago and I didn't want to bother you guys. I'm listening and I'll come back to it when we come to that presentation.

CHAIRMAN BANERJEE: Mike, when you want to ask the question, just make a loud noise, so we know.

MEMBER CORRADINI: Should I clap or what?

CHAIRMAN BANERJEE: Yes, of course.

MEMBER CORRADINI: Okay, fine.

MEMBER ABDEL-KHALIK: Just to be clear, what is meant by the word "recommended" on this slide? Is it option 1B in your --

MR. SCOTT: It was the combination of -- I believe it was 1B and 2, right? 1 bravo and 2. In other words, it's what we recommended to the SECY paper.

MEMBER ABDEL-KHALIK: All right, thank you.

MR. HOTT: Next slide. All right the next presentation will be on general design criterion 4. It will be given by Tim Lupold and John Tsao. Those gentlemen will be followed by Tim Collins and Steve Dinsmore who will give a presentation on risk-inform considerations and the proposed 10 CFR 50.46(a) rulemaking.

Following Tim's and Steve's presentation, we'll provide a brief summary presentation.

CHAIRMAN BANERJEE: Let me before we move on, ask the Committee, would you like a three-minute break? Four-minute break? All right.

We will take a three-minute break and then -- four minutes. Five top. A five-minute break and then we will be back. Is that okay with you, Mike?

MR. HOTT: Sure.

CHAIRMAN BANERJEE: We're off the record now.

(Whereupon, the above-entitled matter went off the record at 2:29 p.m. and resumed at 2:36 p.m.)

CHAIRMAN BANERJEE: We are now in session and on the record.

4. POTENTIAL APPROACHES TO BRING GSI-191 TO CLOSURE

MR. SCOTT: Okay. So now we are going to discuss with you our position on the application of general design criteria in IV, specifically leak-before-break, for the resolution of GSI-191 issues. And our presenters will be Tim Lupold and John Tsao. So, Tim, take it away.

MR. LUPOLD: Good afternoon, everyone. I am Tim Lupold, the Branch Chief of the Piping and NDE Branch in the Division of Component Integrity in NRR. And with me is John Tsao. John is our technical expert on LBB within the branch.

I would like to take a quick review, a few minutes to do a quick review, of the recent events that got us to this point. Chris talked about the letters that were generated.

We had a staff meeting here, a meeting with the Commission scheduled April the 15th to discuss the actions for GSI-191. And prior to that meeting, Nuclear Energy Institute sent a letter urging the NRC to consider the application of GDC-4 as a means to resolve the remaining GSI-191 issues and concerns. Specifically, the use of GDC-4 LBB would be used to analytically reduce the amount of debris that would be transported to the sump.

The Union of Concerned Scientists also sent us a letter dated April 14th and requested the NRC not permit the application of GDC-4 to address the remaining issues of GSI-191. So we have opposing viewpoints here to look at and resolve.

And on April 15th, the Commission held a meeting, during which both the industry and the staff gave perspectives relating to the remaining issues associated with GSI-191. As a result of the meeting, the Commission issued an SRM requesting we provide a notation vote policy paper on the potential approaches to bring GSI-191 to closure. In the SRM, the Commission specifically identified GDC-4 as one of the items to be discussed in the policy paper. And we are here today as a result of that.

Okay. A little bit of background. GDC-4 permits the dynamic effects from pipe rupture to be excluded when analyses that are reviewed and approved by the Commission demonstrate an extremely low probability of pipe ruptures.

The analyses referred to in GDC-4 are related to leak-before-break methodology. And the leak-before-break concept is based on testing and analysis verifying pipe material has sufficient resistance to uncontrollable crack propagation.

In other words, the pipe will most likely develop a small crack such that an operator would identify the leakage and then take actions before there is an actual rupture of the piping system. And we placed in the standard review plan 3.6.3 the guidance on how LBB analyses are performed.

MEMBER SHACK: Just on your first bullet, the quibble, you don't really demonstrate a low probability of pipe rupture. You demonstrate a deterministic analysis, from which you conclude that the probability of pipe rupture is extremely low.

MR. LUPOLD: You are exactly correct. We ensure that there is a margin of safety between the size of the flaw that will produce ten times the leakage. And then given that flaw size, we assure that there is a margin of two between that and the size that would lead to an unstable rupture of the pipe.

But it is. You are right. LBB is not really a probabilistic approach. It is a deterministic approach to show that you have a low probability of rupture. Very good point.

MEMBER SHACK: You infer that you have a low probability of rupture.

MR. LUPOLD: That is exactly right. Very good point.

Now, when LBB was first incorporated in the GDC-4 regulations, the rulemaking included statements of consideration to provide insights regarding the intent of the rule, you know, why it was being adopted. And some of these ideas are captured here.

The first idea was that LBB credit enhances safety through the removal of plant hardware. There used to be pipe whip restraints, jet impingement barriers out in the plant. These components would sometimes inhibit inspections that were called for within the ASME section 11 inspection program.

And, therefore, the thought was that these are some of the negative effects of plant performance. And LBB would give licensees the option to remove such components. Therefore, they would be able to do more inspections and better inspections on these components.

The idea was that they could do that while not affecting emergency core cooling systems, containments, or the environmental qualification of mechanical and electrical equipment. Okay.

Also, LBB applies to local and not global dynamic effects. And LBB removes the requirement to consider jet impingement forces on adjacent components. The decompression waves within the system did not have to be considered. And dynamic pressurization in cavities, subcompartments, and compartments did not need to be considered.

Okay. Now it's --

DR. WALLIS: This applies to pipes presumably.

MR. LUPOLD: This applies to pipes.

DR. WALLIS: I was thinking about

Davis-Besse. I don't know why, but was there leak-before-break? I would think that that ladder at Davis-Besse would have popped without leaking.

MR. LUPOLD: You're referring to --

DR. WALLIS: Because you have a larger LOCA than --

MR. LUPOLD: -- the Davis-Besse reactor vessel head?

DR. WALLIS: Yes. You have got a larger LOCA than some of the transition pipe sizes that are suggested.

MR. LUPOLD: That is a potential. I mean, that could have occurred. I mean, granted, there was a leak there that caused the cavity of the head. That leak occurred for --

DR. WALLIS: And that was apparently not taken seriously.

MR. LUPOLD: Well, I don't really want to go into all of this. It's associated with Davis-Besse, but --

DR. WALLIS: I was just thinking about it. Yes.

MR. TSAO: But leak-before-break is applied to piping, not --

DR. WALLIS: I knew that. That's right.

I know. But I was just --

MEMBER SHACK: It also assumes you'll do something about the leak when you know it's there.

MR. LUPOLD: Yes.

DR. KRESS: It also assumes you'll know it's there.

MR. LUPOLD: Yes, it does. Okay. Let's look at some of the advantages of applying GDC-4 to the issues remaining for GSI-191. Plants have already replaced some of the insulation, may not need to replace any additional insulation because they wouldn't have to assume that that insulation is transported to the sump.

Also, plants that have not replaced insulation at all to this point the application would likely reduce the scope and the number of needed insulation change-outs at that plant. And as the amount of insulation that needs to be considered from transport to the sump is reduced, it may the eliminate need for additional strainer testing.

And that may provide those licensees who have already shown satisfactory strainer performance the potential to recover operational margins. In other words, they may have another modification they want to do, and they can take credit, then, for some of this additional margin it may give them and allow that to justify these other modifications, whatever they may be.

DR. WALLIS: All these statements are mights and coulds. And so we don't really know what the consequence would be. These are things that might happen.

MR. LUPOLD: Well, if we were going to make this go with the approach that GDC-4 is applied to these piping systems --

DR. WALLIS: It seems to me if we are going to make a decision, it is nice to know what the consequences really are likely to be, not what they might be.

MR. SCOTT: Here's the thing. It's all extremely plant-specific. And you can't know the answer to it until you do the evaluation. And the evaluation has not been done. So I --

DR. WALLIS: So why would you make the decision to apply it if you don't know the consequences of doing it yet?

MR. SCOTT: Well, as you already know from reading the documents, we do not recommend that this approach be taken. We are citing here what the potential -- we are trying to, you know, be straightforward about what this would obtain should the Commission decide to do it.

Now, exactly how much benefit a licensee would obtain, it is true we don't know and I suspect they don't know, although you can ask the industry if they have done some analyses of what would be the impact of this. I'm sure they would be happy to share it.

DR. WALLIS: If the benefit were very large, you might change your conclusion.

MR. SCOTT: We would not change your conclusion because of the cost, which we will talk about it.

MR. LUPOLD: And it is going to be a function of where the problematic insulation is. If it's on these pipes that are used in LBB, there could be a very large benefit from applying GDC-4 to these systems. If it's not, if the insulation which is on these systems which have been analyzed for LBB, if that's not fibrous insulation, then it may not help the situation much at all. And I think some of that bears out and as I go into it in later slides.

And, like Mike said, it is plant-specific. You've got to have to know where your insulation that gives you problems is located at. You know, if it's on these systems, it could give you a big benefit. If it's not --

DR. WALLIS: So this isn't something which might actually make the GSI-191 problem go away quickly by --

MR. SCOTT: What it could do if applied would be to ease the licensee's burden in showing adequate strainer performance. It is not, as we see it, a safety benefit to do this. It would be potentially a negative from the perspective of safety for the reasons that we are going to talk about.

So if you look at benefits broadly, could it help the licensees basically close this issue? Yes. We are not comfortable with that particular form of closure for reasons --

MEMBER ABDEL-KHALIK: Let's just focus on safety. Okay?

MR. SCOTT: That's what we're going to do.

MEMBER ABDEL-KHALIK: All right. Now, GDC-4 was put in place because safety would be enhanced because you would allow the removal of these barriers and, therefore, you would do more inspections. Can you tell me how or perhaps I should reserve this question to industry when they come up, how application of GDC-4 to GSI-191 would enhance safety?

MR. SCOTT: We do not believe it would. And that point is made in our presentation.

MEMBER ABDEL-KHALIK: I do recognize that it is made in your presentation, but you get into a lot of arguments about local versus global effects and whether or not GDC-4 applies.

But that is really -- I mean, you're spending a lot of time without focusing on the heart of the issue. This is in place because it enhances safety.

MR. SCOTT: With that, I suggest that we proceed to why we agree with you.

MEMBER ABDEL-KHALIK: Okay.

MR. LUPOLD: Let's take a look at a couple, at some of the disadvantages associated with applying GDC-4 to the GSI-191 issues. Systems and components are generally designed to provide defense-in-depth, such as did unexpected events occur, other systems or components will still be able to function.

In this case, large amounts of problematic materials may be left in containment, while the probability of rupture may be very low, it's not zero. And if LBB rupture occurs, then you could have a large reduction in defense-in-depth.

MEMBER ABDEL-KHALIK: I guess the reason I raised the question earlier is that the manner in which this is being presented, advantages versus disadvantages, in my view is not the right way to address this. It's whether it is consistent with the spirit in which GDC-4 was put in place or not. That is the issue.

MR. LUPOLD: And we tried to take a holistic look at this to look at what the advantages and disadvantages would be, but it's not intermingled in this what those advantages relating to safety are and what those disadvantages relating to safety are.

Now, how does it negatively impact safety? How does it positively impact safety?

MR. SCOTT: The original intent, which is what you're referring to, matters, but the Commission could choose to take a different approach to this, despite what the intent was when GDC-4 was revised. So the intent is a part of it, but it's not the only part. We believe it's a significant part, but there are many other aspects of why we don't think this is the right thing to do.

Even if the Commission today were to take a clean slate look at it and say, "Despite what we did in the past, here is what we think we ought to do now," we are trying to make the case and made the case to the Commission in the SECY paper that that is not the right thing to do. It's a much broader argument.

MEMBER ABDEL-KHALIK: Okay. Thank you.

MR. LUPOLD: And just the last few bullets we have here, there has been testing done that shows the small amounts and combinations of debris have shown that there would be a problem with sump performance. And small amounts and specific combinations have led to sump failure in those tests.

Also, sump failure following a LOCA in a LBB piping would likely cause a failure of ECCS core cooling, a preventative feature, and also result in the loss of containment spray system and without any other protection system failures.

So, continuing on with disadvantages --

CHAIRMAN BANERJEE: So if you sort of took this logically one more step, you could say that LBB could be used to significantly reduce the capabilities of the ECCS system. I mean, it's in the same vein.

MR. LUPOLD: I think what we are trying to say is that if you --

CHAIRMAN BANERJEE: What is the distinction? I mean, this approach would be used to say, "Well, we don't need ECCS for more" --

MR. SCOTT: It could be used to say we don't need a number of things.

CHAIRMAN BANERJEE: Right. This is one. But then take the next step: to get rid of the ECCS and perhaps even the containment after that.

MR. LUPOLD: You're getting into one of the fears that the staff has, that if GDC-4 is applied in this particular application, what is the next application that is going to be applied? And then what is the next application it is going to be applied to?

And how is it going to change the general design and analysis of plant systems in the analysis --

CHAIRMAN BANERJEE: I mean, Said's argument was that originally it was applied to enhance safety, which was clearly an acceptable direction.

But now you're applying it in a way which --

MEMBER ABDEL-KHALIK: Does not.

CHAIRMAN BANERJEE: -- does not. And it seems what you're making a clear argument is that these people have converted, obviously, but it does reduce defense-in-depth. It's clear.

MR. SCOTT: It has a number of -- this is why it takes us several slides to go over all of these impacts, several of which you cited. And there are some yet to be discussed.

MEMBER SHACK: Well, I mean it's inconsistent with the guidance the Commission has provided for 50.46a, which was retain the ability to mitigate large break LOCAs.

MR. SCOTT: And that's another one of our bullets.

MEMBER SHACK: Right, somewhere along the way.

MR. SCOTT: We're getting there. It just takes us a while.

MEMBER SHACK: All right. So the Commission would have to sort of change its mind about that position.

MR. LUPOLD: Right.

MR. SCOTT: There would be a number of changes should they go that direction, yes.

MR. LUPOLD: Maybe I should just quickly move through these and get right more into the back of the heart of the policy considerations. But I will mention --

MEMBER SHACK: This one doesn't seem to me to apply particularly to GDC-4. This is a leak-before-break question.

MR. LUPOLD: Yes, primary washer stress --

MEMBER SHACK: Yes. You guys have to address that anyway.

MR. LUPOLD: Right. We have to address this anyway. But right now we have not really addressed PWSCC associated with those lines that --

MEMBER SHACK: But you're piling --

MR. LUPOLD: -- have been analyzed for LBB.

MEMBER SHACK: Yes.

MR. LUPOLD: I mean, we put interim actions in place to increase -- actually, the industry voluntarily put forth actions together to increase the inspection frequency associated with these welds that contained nickel alloy.

The staff has taken actions, too, working with ASME to create code cases for increasing the frequency of the examinations of these welds. And we're in the process in our most recent -- our current rulemaking to mandate the use of the code cases for the volumetric inspections of these welds.

We consider that to be an interim measure. Inspections aren't mitigation. And we're working long term with the Office of Research on a computer module, which is to demonstrate an extremely low probability of rupture for these piping systems. And that is an ongoing effort, which is going to take a number of years before this PWSCC issue is addressed completely for these systems, which contain nickel alloys.

The point here is, though, that a lot of these systems we're talking about for LBB, they contain these nickel alloy welds. And so that is really an issue that we have to be cognizant of. And if we're going to say that GDC-4 should be applied, we need to know that and make that conscious decision that, even with this, we're still going to apply it.

All right. Let's go on to the next slide, then. Okay. GDC-4, if it is approved for application to GSI-191, the dynamic effects from non-LBB piping and loss-of-coolant accident, sources, such as manways, valve bonnet blow-outs, they still need to be considered in debris generation. So there are still piping systems out there that have to be looked at, have to be analyzed when you consider what debris will be generated, and how it's transported to the sumps.

MEMBER ABDEL-KHALIK: Just a question out of curiosity. In your write-up, you talk about squib valves. Are there any current plans, PWRs, that have squib valves in them?

MR. SCOTT: I'm not aware of any.

MR. LUPOLD: I'm not aware of any either, but, I mean, this was I think squib valves were being talked about for some of the new --

MEMBER ABDEL-KHALIK: For the new plants. But what --

MR. SCOTT: Chris Hott, do you recall what section that was in? I don't recall the reference. Do you? It's in the LBB discussion? Okay. Did you all --

MR. LUPOLD: I don't think there are specific ones, but I know that that is being used in some plants in the future. I don't even know if they would be impacted.

MEMBER ABDEL-KHALIK: But your write-up -- I was just curious. That's all.

MR. SCOTT: I'm not aware of it. So that probably is a little bit out of place.

MEMBER ABDEL-KHALIK: Right. Okay.

MR. LUPOLD: But the point here is that there are other sources of debris generation beyond those that are used for LBB. And that would have to be looked at and analyzed still.

MR. SCOTT: Let me make one more point. Other than I think there is a single paragraph in the parent document in the SECY paper that addresses new reactors, in no way does any of this presentation intend to address new reactors. That's a separate thing.

MEMBER ABDEL-KHALIK: That was my understanding.

MR. LUPOLD: Okay. Typically LBB has not been applied for on a lot of the smaller piping systems. Every plant in the country has had it applied to the reactor coolant system loop piping.

And a lot of plants have also applied it to the pressurizer surge line, their shutdown cool line, or residual heat removal lines. And there have been other lines and things like that that they have applied to. But not all plants have actually requested LBB approval beyond the reactor coolant system, loop piping. So there are some rather large pipes still out there that need to be analyzed, even if GDC-4 is used to address GSI-191 issues.

Some of the policy considerations that have to be looked at. I'll start wrapping this whole thing up. Approving LBB for GSI-191 would be inconsistent with defense-in-depth principles. All right? Because we don't want a failure of a system to then cause failure of another system and then result in, well, lack of cooling to the core without any additional failures that have to take place. All right?

Also, approving LBB for GSI-191, as was mentioned here already, would be inconsistent with the proposed rulemaking for 10 CFR 50.46a. And specifically that proposed rulemaking would say that you have to have the capability to mitigate the full spectrum of LOCAs. And this would be eliminating some of those LOCAs that would have to be considered under 50.46a. Okay?

And allowing LBB to be used as the basis for not further modifying sump screens or not removing sources of debris may prevent ECCS systems from performing its design function, which is contrary to licensees being able to successfully mitigate the full spectrum. All right?

DR. WALLIS: Well, I thought in 50.46a, there was some suggestion of allowing the probability of successful mitigation to be less for bigger pipes.

MR. LUPOLD: I don't know a lot about 50.46a, but I think 50.46a does give you certain provisions on how you address different pipe breaks.

It gives you some latitude that would not be there currently.

MR. COLLINS: I'm sorry? This is Tim Collins from the staff. I didn't understand your question, Dr. Wallis.

DR. WALLIS: Well, to successfully mitigate, if you could show that the -- I thought that there was some relaxation of the way in which you had to successfully mitigate for the leaked pipes.

MR. COLLINS: Yes, the relaxation in --

DR. WALLIS: The probabilities were not quite so big.

MR. COLLINS: Now, for breaks that are larger than a transition break size, which are assumed to be the lower probability events, your mitigation analysis does not have to assume a loss of off-site power. And the mitigation analysis does not have to assume a single failure. And you can also take credit for non-safety-grade equipment in 50.46a.

DR. WALLIS: That's right.

MR. COLLINS: Those are the relaxations.

DR. WALLIS: Well, when the staff came before the ACRS, they talked about allowing instead of sort of a 95/95 presentation of probability, when you do your statistics, allowing something not quite so strenuous as a requirement --

MR. COLLINS: Well, the current wording in the --

DR. WALLIS: -- that isn't in there at all.

MR. COLLINS: Pardon me?

DR. WALLIS: That isn't in there?

MR. COLLINS: In the current version of 50.46, which is being proposed for the Commission, --

DR. WALLIS: Yes.

MR. COLLINS: -- there is still a requirement for a high probability of success in the mitigation, even for breaks beyond --

DR. WALLIS: Now, the higher probability is still the same. It's still the same.

MR. COLLINS: It's still the same, yes.

DR. WALLIS: So that is a change from what was proposed a few years ago by the staff.

MR. COLLINS: Well, it's changed.

DR. WALLIS: Okay.

MR. COLLINS: It's been going on for six years. There have been changes to it all along.

CHAIRMAN BANERJEE: Mike, you have a question?

MEMBER CORRADINI: No, I don't, not just

yet. Graham asked one question. I guess I wanted to follow up with the core contingencies that the gentleman just named about 50.46a So we are going to come back. That will actually be part of the risk-informed --

CHAIRMAN BANERJEE: Right, right, yes.

MEMBER CORRADINI: All right. Thank you.

CHAIRMAN BANERJEE: Okay. Carry on.

MR. LUPOLD: Okay. Now, a policy decision to expand GDC-4 to allow credit for GSI-191 would presumably include a Commission decision for the change such that it would not result in an unacceptable reduction in defense-in-depth; is appropriate, even though there is no perceived safety benefit, which we have talked about here today; would not result in unintended consequences; example, unacceptable precedents for the use of LBB. We mentioned that also because if it's opened up here, you know, how is it going to affect other things, such as containment spray or ECCS operation accident analyses.

MEMBER SHACK: We've never been consistent before. Why worry about it now?

MR. SCOTT: Well, we strive.

MR. LUPOLD: Okay. Also --

MEMBER ABDEL-KHALIK: Can I reverse the second sub-bullet? Can one reach the conclusion that it is appropriate, even though there is a safety detriment?

MR. LUPOLD: Well, I guess you could look at it, and you could determine the degree.

MEMBER SHACK: There is detriment --

MEMBER ABDEL-KHALIK: That's the other side of it.

MR. LUPOLD: You have to look at it and see if it's not too much of an increase.

MR. SCOTT: In a broader sense.

MR. LUPOLD: In a boarder sense, yes.

MR. SCOTT: Not reactor safety.

MR. LUPOLD: Not reactor safety.

MEMBER ABDEL-KHALIK: Right.

CHAIRMAN BANERJEE: Not public safety.

MR. LUPOLD: Not public safety.

MEMBER SHACK: Workers are people, too.

MR. SCOTT: But they're not members of the public in this sense.

MR. LUPOLD: Okay. Also, if we decide to expand GDC-4, we would have to make that cognizant of the fact that PWSCC is an issue out there. And it's applicable to a lot of the piping systems that are used here.

And if we apply it, it would also require revising some of the statements of consideration that were made during the original -- the last change of GDC-4. So we would have to change those, possibly go through not really a rulemaking but maybe a public comment period associated with those statements of consideration, so not something that couldn't be done. It's just some work that staff would have to go through.

MR. SCOTT: The one point to be made there is any way you slide this, even if the Commission approves it, it is not an immediate implement it now, we're done with GSI-191.

CHAIRMAN BANERJEE: Why would you have to revise the rule?

MR. LUPOLD: The statements of consideration, some of the statements of consideration here, stated that -- it talked about why the rule was implemented --

CHAIRMAN BANERJEE: Oh, I see.

MR. LUPOLD: -- and the fact that you're getting a safety benefit by implementing the rules because you can take off the barriers, et cetera. We would have to change some of that around a little bit, allow for public comment maybe.

MEMBER RYAN: The safety benefits and detriments are all in one equation. It's a safety effect.

MR. LUPOLD: Right.

MEMBER RYAN: So, I mean, you can't pick on the safety benefits or perceived benefits. You have to look at benefits and detriments and where am I in the total compared to where I was without, right?

MR. LUPOLD: Absolutely.

MEMBER RYAN: Okay.

MR. LUPOLD: Absolutely, yes. You have to present the balanced picture.

MEMBER RYAN: Fair enough.

MR. LUPOLD: Okay. So, considering everything we have talked about up to this point, then it came down to the recommendations. And the staff did not recommend that GDC-4 be applied to the sump evaluation resulting in GSI-191.

And you can see the reasoning there. These are items that we have talked about up to this point: inconsistent with the original intent of GDC-4, PWSCC concerns, inconsistent with what we believe --

CHAIRMAN BANERJEE: What is the PWSCC

concern again, I mean, you went over it, but why is it specifically a concern for this issue?

MR. SCOTT: Part of it is the principle of expanding the application of GDC-4 in the presence of that unresolved issue.

CHAIRMAN BANERJEE: Okay.

MR. LUPOLD: You can also take a look at that. And if we were looking at a brand new system and it had nickel alloy welds in it, knowing what we do today about PWSCC, it may not pass the criteria for application of LBB.

MEMBER CORRADINI: So, Sanjoy, can I ask a question?

CHAIRMAN BANERJEE: Please. Go ahead.

MEMBER CORRADINI: Okay. I guess I want to go back to Said's question, which he raised at the very beginning, which is the only motivation that I see for engaging in GDC-4 is if you have a safety benefit, period.

And so you guys were giving some examples, but it seems to me the only example which has come to the floor which is actually practicable is this one that is already being used. Anything else is really relieving burden versus actually improving safety.

MR. LUPOLD: Right. That is a significant item that was in the statements of consideration --

MEMBER CORRADINI: Okay. Fine.

MR. LUPOLD: -- for implementing GDC-4. And we would have to address it.

MEMBER CORRADINI: Okay. Fine. Thank you.

MR. SCOTT: This is about relieving burden.

CHAIRMAN BANERJEE: Go ahead.

MR. LUPOLD: So that really wraps up what I came here to tell you about today.

CHAIRMAN BANERJEE: Okay.

MR. LUPOLD: Other questions?

CHAIRMAN BANERJEE: Any questions before we let Tim off the hook and John?

(No response.)

CHAIRMAN BANERJEE: We can always bring you back.

MR. LUPOLD: Absolutely.

CHAIRMAN BANERJEE: All right. Mike, the next one?

MR. SCOTT: Okay. Now we're going to talk about risk --

CHAIRMAN BANERJEE: Thank you.

MR. SCOTT: -- and 10 CFR 50.46 alpha

after I find it. And we have Tim Collins and Steve Dinsmore here to present to you. Are we ready to proceed?

MR. COLLINS: Yes.

MR. SCOTT: Go ahead.

MR. COLLINS: My name Tim Collins. And I'm here with Steve Dinsmore. We're here to discuss how the staff has attempted to risk-inform the resolution path for GSI-191 with the emphasis on those plants that have not yet demonstrated adequate strainer performance.

The main message we're trying to convey today is that we believe that the approach being recommended in the Commission paper is, in fact, risk-informed; that it is consistent with the established guidance on risk-informed decision-making; the matter properly takes into account the limitations in phenomenological modeling that we have run into in GSI-191; and that it is consistent with the most current staff thinking in the proposed 50.46a rulemaking, the rulemaking that is intended to risk-inform the ECCS requirements in general.

So in our presentation, we plan to brief the review of the high-level guide in 1.174 and discuss the challenges that GSI-191 presents in trying to meet that guidance and then discuss what approval of 50.46a might mean for GSI-191.

Next slide. So, first of all, so that we keep it in focus, I want to simply restate the recommended staff position that Chris Hott talked about earlier, basically that LOCAs that have the greater risk significance, the smaller breaks, should be resolved in the near term and that less likely LOCAs should be addressed in the longer term and that the Commission decision on 50.46a should be used to update risk-informed approaches to GSI-191.

Now, this plan requires that long-term cooling capability for all breaks up to the double-ended guillotine break of the largest pipe in the RCS be provided. This is required by the current regulations in 50.46, and it is still recommended in the current version os 50.46a.

However, the plan also recognizes the lower likelihood and, therefore, the lower risk significance of the larger LOCAs. And it, accordingly, allowed more time for testing refinements or planning for more efficient plant mods that may be needed for resolution. It allows time to take advantage of any relaxation to the ECCS requirements that may be afforded if the Commission assumes 50.46a.

Okay. Slide 3. Here we go. Now, this is just a high-level summary of the guidelines in reg guide 1.174. And I wanted to summarize them and then talk about the challenges to meeting these guidelines that GSI-191 may present.

Okay. Reg guide 1.174 basically says that for a change to be acceptable in a risk-informed resolution, it should have an acceptable change in risk, it should maintain sufficient defense-in-depth, it should maintain safety margins, and it should have a monitoring program that assures that the conditions assumed in the written analysis are preserved in the plant.

Now, we focused on two of these guidelines when assessing the challenges to risk-informing GSI-191. The first guideline is the change in risk, and the second one is maintaining defense-in-depth.

Next slide. Now, the factor that most complicates risk-informing the GSI-191 resolution is the inability to realistically model key phenomena. Models and major factors, such as debris generation and transport, are highly uncertain. And models for debris bed head loss simply don't exist. Thus, the development propagation of probability distributions is greatly hindered. And we consider it unfeasible at this time.

This limitation has important implications for the assessment of both the change in risk and defense-in-depth because it drives us to use bounding estimates.

Now, this slide illustrates how the use of the bounding estimates impacts the change in risk guideline. In the absence of better models, bounding estimates are used for the sump-clogging probability if a plant has unproven strainer capability and it has a high fiber load or an in-bed potential. For example, the probabilities of a five-inch break are about 5 times 10-5 per year if you look at the expert elicitation report that supports 50.46a.

A break of that size requires you to go into recirculation for long-term cooling. When a bounding clogging probability of 1.0 is assumed, the delta risk is too large unless some sort of recovery action is demonstrated to be reliable, maybe back-flushing, maybe some extended injection or modification to add some active system of some sort.

Now, we used the bounding estimates because our testing experience has shown that the potential for significant head loss is very real. Okay? And at the same time, we have the weaknesses or the absence of the models that we need to to do a better analysis.

Okay? Next slide. Now, the use of bounding estimates -- and we consider all of the LOCAs that are in the licensing basis of the plant. So we go all the way up to the double-ended guillotine of the largest pipe in the reactor coolant system.

Now, the largest LOCAs have a probability of occurrence that is probably low enough that they could satisfy the change in risk criteria and if you assume 1.0 failure probability for the sump.

But this configuration wouldn't satisfy defense-in-depth considerations because there would be no layers of protection between the initiating event and core melt. No additional failures would be needed. So protection would be solely provided by the low probability of an initiating event. And that's just inconsistent with defense-in-depth. Defense-in-depth talks about layers of protection. There are no layers of protection between the initiating event and core damage.

There is also a secondary lesser defense-in-depth degradation in such a design. And that is that an incapable sump not only severely degrades the plant's severe accident prevention capability. It also degrades the plant's severe accident consequence mitigation capability since the containment spray system is also disabled if the sump fails. So we have both --

CHAIRMAN BANERJEE: Does it not allow you to take recovery actions?

MR. COLLINS: That's what I tired to say in the --

CHAIRMAN BANERJEE: The previous slide, right?

MR. COLLINS: -- previous slide. Yes, yes. None of the licensees to date have tried to take credit for any recovery actions.

MR. SCOTT: There are various beyond design basis actions that they could take, which, again, that goes back to the compensatory actions a la bullet 2000-301. But that is outside the design basis.

MEMBER CORRADINI: So can I ask a question at this point?

CHAIRMAN BANERJEE: Sure.

MEMBER CORRADINI: So I am sure NEI is going to come up. We can ask them. But I am curious. When you talk with the industry, why don't they consider recovery actions? Is it a cost issue?

MR. COLLINS: Well, that's a question for the industry, I think.

MEMBER CORRADINI: Well, but, I mean, you are allowed to speculate maybe.

MR. SCOTT: They could put other actions into their design bases if they could support that they worked.

MEMBER CORRADINI: Okay.

MR. SCOTT: And none of those actions that was taken for bulletin 2000-301 or that was put on the menu of possible actions is free of down sides. I mean, even --

MEMBER CORRADINI: I understand that. So your point is they have to be safety-grade level of recovery actions, and they would have to do a test program or some combination of tests and analysis to give you confidence that they were adequate?

MR. SCOTT: Yes.

MR. DINSMORE: Yes. This is Steve Dinsmore from NRR. I guess this recovery, they don't have to be safety-grade if they were dealing with LOCAs less than the TBS, for example, that --

MEMBER CORRADINI: Greater?

MR. DINSMORE: No. Safety-grade if it was less is what I meant to say.

MR. SCOTT: Right, right.

MEMBER CORRADINI: Yes. I understood. I figured it was what you were going at.

MR. DINSMORE: If this rule is implemented.

MR. SCOTT: Yes. If 50.46a is implemented and we review these things according to 50.46a.

MEMBER CORRADINI: Right.

MR. SCOTT: But there have been a number of studies about these recovery actions I list here: turning off sprays, turning off redundant trains, throttling ECCS flows, cycling pumps, refilling our WST, accessing other units, RWST, spent fuel poop sources.

So there have been a lot of recovery actions.

MR. DINSMORE: But, again, if they don't implement 50.46a so that they can use these things however best they can figure them out -- well, that would be the best way for them to use these things.

MEMBER SHACK: But 50.46a would give them the option of looking at all of those actions for the large breaks.

MR. DINSMORE: Yes. I guess they could now as well to some extent, but I am not --

MEMBER CORRADINI: But they would have to be safety-grade.

MR. DINSMORE: Yes.

MR. COLLINS: Or they would have to get exemptions, --

MEMBER CORRADINI: Sorry. Yes.

MR. COLLINS: -- which comes onto the next slide. I mean, we have some experience in trying to risk-inform GSI-191.

MEMBER CORRADINI: Right.

MR. COLLINS: I mean, this isn't just brand new. And back in 2004, the staff had endorsed an NEI-proposed methodology that was developed on the basis of what was the then current 50.46a rulemaking. Right?

But no licensee had implemented that methodology. And our understanding of the reasons for that was that licensee had an expectation at that time that their strainer testing was going to be successful. Okay? And it would have required the use of exemption because the methodology did relax assumptions, which are required under 50.46.

And then there were also the modeling issues involved with trying to demonstrate the risk implications.

CHAIRMAN BANERJEE: Something like back-flushing, as you mentioned in one of your previous slides, could be considered. Of course, there could be significant down sides to that as well.

MR. SCOTT: It would favor sending debris downstream. And, of course, under this framework, you would need to show that it works: safety or not.

CHAIRMAN BANERJEE: Now, if you look at internationally, what is happening there, the Germans do this. They have strainers with holes which are smaller than the holes in the strainer.

MR. SCOTT: They have different design criteria for core cooling.

CHAIRMAN BANERJEE: Right.

MR. SCOTT: They don't have a sump buffer, as I recall. That is different for them.

CHAIRMAN BANERJEE: Right.

MR. SCOTT: Different materials in containment, different insulation. There are a lot of differences. But back-flush is part of their design basis solution set for I think all but one of their plants.

CHAIRMAN BANERJEE: But the downstream effects, I don't know whether they have examined that because it's implicit in their sort of assumption that if they make the holes in the strainer small enough, it will prevent fine stuff getting into the core, which is not true.

MR. SCOTT: As I understand it, they replaced their strainer. The original design -- I don't remember the size, but, whatever it was, they went in and replaced them for just that reason: to minimize the bypass.

CHAIRMAN BANERJEE: Yes. Anyway, that's a whole separate game. So let's carry on.

MR. COLLINS: Okay. Well, the next slide I want to discuss the current version of 50.46a, the 2010 version. This is the rule that is scheduled to go to the Commission in December.

It represents the current staff thinking on what risk-informing ECCS requirements in general ought to be. And the most significant features of the rule are that the largest break that has to be analyzed as a design basis accident has changed from a double-ended guillotine break of the largest pipe in the reactor coolant system to the single-sided break of the largest attached pipe. Area-wise, it's almost a factor of ten reduction.

However, the proposed rule would still require that mitigation be demonstrated for larger

LOCAs all the way up to the double-ended guillotine break except you can use the relaxed assumptions that I spoke about a few minutes ago because you don't have to assume a single failure, you don't have to assume loss of off-site power, and you can take credit for non-safety-grade equipment.

And, finally, any subsequent changes that you make to the plant that depend upon the relaxed ECCS requirements have to be supported by a risk-informed analysis, which meets the guidelines basically of 1.174.

MEMBER CORRADINI: That last bullet, can I get a clarification? So what you're really telling me is from a practical matter, by lowering the size, you have essentially allowed for an increased risk. But the amount of increased risk is small because the risk-benefit that was originally there was small.

MR. COLLINS: I don't understand the last part of your statement.

MEMBER CORRADINI: In other words, let me take you the two directions. If one direction is that I maintained the double-ended guillotine break, single failure criteria, only safety-related equipment, then the argument was as I press through the transition break size to larger and larger sizes, I am essentially -- how would I put it? The risk-benefit is small.

MR. COLLINS: Okay. Yes. I think that's fair.

MEMBER CORRADINI: Okay. And now with you backing off from that by this approach, now at transition break size, you allow for a different set of allowable initial and boundary conditions to do the analysis to allow the equipment to behave. Now you're going to have someone analyze what that risk impact is.

MR. COLLINS: That's correct.

MEMBER CORRADINI: Okay. And so the comparison point there is what, similar to 1.174?

MR. DINSMORE: Yes. This is Steve Dinsmore. The comparisons point is 1.174 as modified by the last SRM that came down for 50.46a, which said --

MEMBER CORRADINI: Steve, can you say that slower? I'm sorry.

MR. DINSMORE: Okay. Sorry.

MEMBER CORRADINI: That's all right.

MR. DINSMORE: The comparison point is 1.174 as modified by the last Commission SRM on 50.46a that said we should make sure these are very small risk increases, as opposed to small risk increase.

MEMBER CORRADINI: Good. So please tell me what the adverbs help me with there.

MR. DINSMORE: Okay. Yes. Small risk increase is normally 10-5 or less for CDF, 10-6 or less for LERF, very small increases normally, 10-6 or less for CDF, 10-7 or less for LERF.

MEMBER CORRADINI: Okay. Thank you. All right. That helps me. Thank you very much.

MR. DINSMORE: Okay.

CHAIRMAN BANERJEE: The implication of all of this, though, would be that you would still have to consider the largest LOCAs, but you might get some relief because of some of these other things.

MEMBER CORRADINI: Right. I was trying to understand that. I guess, Sanjoy, that was what I am trying to get at, which is I really am saying that I am allowing for more things to either actuate or be involved in the analysis that gives me benefit, not that I don't consider the physical process.

MR. DINSMORE: That's correct.

CHAIRMAN BANERJEE: Right. It may not buy you a whole lot, but --

MEMBER CORRADINI: Yes. It may not.

DR. WALLIS: If you can't cool a core long term with your pumps, then not having off-site power isn't going to make any difference, is it?

MEMBER CORRADINI: Right. If you foul them up with crap, they're still fouled up.

DR. WALLIS: Yes.

MR. SCOTT: I don't think that this off-site power is the big player in this issue.

MEMBER SHACK: It's the next page.

MR. COLLINS: Yes. Let's go to the next slide. The next slide discusses what the potential impact might be on 191 resolution. I mean, I recognize since the acceptance criteria is similar to those in 1.174, all the difficulties that we talked about regarding risk-informing this apply to this problem. Okay?

However, you can apply, non-safety equipment can apply, some flexibility for treating the larger LOCAs. You know, perhaps they want to do a back-flush system or perhaps they want to make some modification to their screens to add an active feature of some sort or take credit for other operator actions that involve non-safety equipment. They could then take credit for that. Now, how much benefit it is to them depends on what their problems are, I guess.

There is also the potential for some

benefit relative to justifying the debris source term for beyond the DBA assumptions. Typically the staff requires less rigor and justifications for beyond design basis events, as opposed to DBA events. Okay?

For example, in a DBA, we require a clear demonstration of capability. When we're treating beyond design basis events, we require more of an expectation, a reasonable expectation, of capability. How much this would be worth in this is hard to say.

DR. WALLIS: How would you get less rigorous about a debris source term?

MR. COLLINS: Pardon me?

DR. WALLIS: How would you get less rigorous about a debris source term?

MR. SCOTT: That's something we would have to work out. We started asking ourselves those questions. The answers are not easy, which is why you see the little parenthetical in here, "Potential limited benefit." There are enough uncertainties that we struggle with this.

And I'm sure that's part of the reason why industry is not -- I mean, this was not their preferred approach. LBB was a clear path forward. We don't have to consider a subset of breaks. In this one, you're still considering them all. You have a very complex issue with a number of tentacles. And so you are proposing to try to ease up a little bit on some of those. How do you do that? That is your question. I can't give you a satisfying answer, but that is why we are allowing a year.

DR. WALLIS: But, for example, you might say you could justify a smaller zone of influence or something like that.

MR. SCOTT: We could probably live with more uncertainty in a smaller zone of influence. Now, you know, they're still going to have -- you are not going to find the NRC staff saying, "Well, okay. We'll just take it at face value. That is not going to happen."

So we don't know how that is going to play out.

MR. COLLINS: We expect, we fully expect, that refined test approaches and insulation replacements are still going to be needed to the high fiber plants, even if you can squeeze out some benefit here. I mean, that is our expectation, but until the industry really tries and we really work with them, it will be hard to tell what we can get out of this. Okay?

MR. SCOTT: What we're trying to say is

that we will be flexible within the context of bringing this thing to closure at what we consider to be a reasonable period of time. We'll allow time to sort this out with the industry if the rule is issued.

MR. COLLINS: Also recognize that plants could have problems with medium LOCAs as well. And this has no effect whatsoever on medium LOCAs.

Also, on this slide, what I want to talk a little bit about is what a licensee would have to do if it wants to implement GSI-191 or implement 50.46a just for the purposes of GSI-191. The reason I want to talk about this a little bit is because in the course of working on 50.46a, we have received public comments which indicate that the burden of this rule is too much for licensees to want to take advantage of it.

So I just wanted to walk through what we saw as necessary for implementation just if you wanted to use it for GSI-191, not for any other plant changes. Okay?

So to adopt 50.46a, a licensee first has to demonstrate the applicability of the underlying basis for the rule. That basically means that they need to show that the expert elicitation report in NUREG-1829 is applicable to their plant.

And they also need to show that the seismic study in NUREG-1903 was applicable to their plant. It was currently a draft regulatory guide, which is out for comment right now, which lays out the process for a licensee would show the applicability of those NUREGs.

It would also need to show any proposed design changes if GSI-191 were to meet the risk-informed criteria of reg guide 1.174, augmented, as Steve said, by that reduction of a factor of vary, which is equal to a factor of 10.

They need to demonstrate their leak detection system is adequate. This basically means that the leak detection system would need to be consistent with the current revision of reg guide 1.145.

MEMBER CORRADINI: So can I ask a question there because I think this is crucial? So are you telling me that the leak detection system would have to be augmented or upgraded or that if they followed this reg guide or -- I can't remember the reg guide you just suggested -- that this would be sufficient.

MR. COLLINS: If they meet reg guide 1.145, we believe that would be sufficient. We understand from interacting with the industry that lots of plants think they may be able to meet that right now.

MEMBER CORRADINI: And just if you could take a minute? Remind me what that is relative to the leakage rate because --

MR. COLLINS: I can't take a minute to do that because I don't know the answer.

MEMBER CORRADINI: Okay. Well, that's fine. I can find that out separately. Thank you.

MR. COLLINS: Okay.

MEMBER ABDEL-KHALIK: I'm trying to understand the meaning of the second sub-bullet in the first bullet. What is it that has to be demonstrated, "Risk-informed criteria must be met"?

MR. COLLINS: Right.

MEMBER ABDEL-KHALIK: With regard to just using this to address GSI-191, what would the applicant have to demonstrate to meet that requirement?

MR. COLLINS: They would need to demonstrate that the change in risk from the configuration that they finalize is sufficiently small, meets the very small criteria.

MEMBER ABDEL-KHALIK: But they have to compare it against what?

MR. DINSMORE: It's easiest to compare to zero. The comparison is between if you brought your plant into full compliance with the regulation, which would mean the sump wouldn't clog more than 50 percent or some strange number, versus what they're proposing to leave it at, which would be, I guess, to plug.

MR. SCOTT: I've got to set the record straight. That 50 percent is not where we're going with the design basis --

MEMBER ABDEL-KHALIK: That's what I'm trying to understand. What are you trying to compare here?

MR. DINSMORE: You're trying to compare compliance with the current regulations versus what you want to do going forward.

MR. SCOTT: In other words, compare it with using a staff-accepted method to provide reasonable assurance that your sump will function under any design basis situation.

MR. DINSMORE: That'll give you a certain risk number, a very small LOCA number.

MEMBER ABDEL-KHALIK: So this is essentially success --

MR. SCOTT: Yes.

MEMBER ABDEL-KHALIK: -- that you have to compare it against.

MR. SCOTT: Successful sump performance if demanded, yes. High probability of successful sump performance if demanded.

MEMBER ABDEL-KHALIK: Versus this change, which will increase the risk by presumably a small acceptable amount.

MR. SCOTT: That is the idea.

MR. COLLINS: Very small amount, yes.

MEMBER ABDEL-KHALIK: I'm still not clear on the basis for the comparison, but I will think through it.

MR. COLLINS: Do you mean what the baseline risk is that you're comparing the change to? Is that what you're --

MEMBER ABDEL-KHALIK: Right.

MR. COLLINS: If you assume a very highly reliable sump in your risk calculation, you would use it as your baseline risk. Then you would have a less reliable sump because of some modifications that still allow some clogging, but, depending on what they do to demonstrate their performance, they would have to make an estimate of the probability of the sump succeeding.

MEMBER ABDEL-KHALIK: But in that case, you are talking about highly reliable sump. And the assessment also includes breaks beyond the transition break size?

MR. COLLINS: Yes, yes.

MEMBER ABDEL-KHALIK: Okay.

CHAIRMAN BANERJEE: But the highly reliable sump could be a very large sump or something, right?

MR. COLLINS: The baseline highly reliable sump. We're thinking --

CHAIRMAN BANERJEE: We're sure will work?

MR. COLLINS: Yes.

CHAIRMAN BANERJEE: Okay. Now we go in with a sump, which the shortest large break is a smaller sump of some sort. So somehow we estimate the probability of this failing in some cases or not. And that increase in risk must be very small.

MR. COLLINS: That's correct.

CHAIRMAN BANERJEE: I guess it would be nice to have a concrete example of this, but we won't have one until somebody tries it, I guess.

MR. COLLINS: That's correct.

CHAIRMAN BANERJEE: All right.

MEMBER SHACK: Well, but this bounding thing is to take the sump at one and then this large-break LOCA frequency.

CHAIRMAN BANERJEE: Right.

MEMBER SHACK: What he's got here is he's still got the defense-in-depth.

MR. COLLINS: That's right.

MEMBER SHACK: I mean, that's the big difference between this -- it's not so much that the delta risks are very different but that the assurance of defense-in-depth is much greater here because you have to be able to mitigate it.

MR. COLLINS: Right. That's correct.

CHAIRMAN BANERJEE: Come again, Bill. I don't fully understand. Suppose the sump doesn't --

MEMBER SHACK: The risk is pretty easy to meet because, even if he assumes it's one because it's only the large break, the's going to meet the delta risk criterion. The thing he has a hard time doing is the defense-in-depth, where he's demonstrating that he has some capability to mitigate the whole large break.

MR. SCOTT: With LBB is what you're talking about.

MEMBER SHACK: Right, right.

MR. SCOTT: You're contrasting LBB with this.

MEMBER SHACK: Well, but --

MR. SCOTT: Aren't you? And even here, I

mean, I do --

CHAIRMAN BANERJEE: How does he mitigate it?

MR. SCOTT: -- my risk-informed criteria. It's an easy thing to do.

MR. COLLINS: You can meet the delta risk criteria, even with a sump failure, a clogging of 1.0.

MR. SCOTT: 1.0.

MR. COLLINS: Right.

MR. DINSMORE: At 14 inches roughly, --

MR. COLLINS: Right.

MR. DINSMORE: -- 14 or 15 inches, pump.

MR. COLLINS: But defense-in-depth is not satisfied.

MEMBER SHACK: Defense-in-depth is not satisfied. So the risk change here is not his limiting thing. That's not the thing that is going to get him.

MR. COLLINS: That's right.

MEMBER SHACK: The thing that is going to get him is to mitigate the large break.

MR. COLLINS: Meeting the defense-in-depth principle.

MEMBER SHACK: Defense-in-depth.

MR. COLLINS: Right, right.

CHAIRMAN BANERJEE: But let's talk about 50.46a. I'm still a little confused. So imagine that you cannot mitigate the largest break, right? Because you have put in a sump which is too small to do that.

MEMBER SHACK: No. But what you don't have to do is actually calculate the reliability of your sump very accurately. You know, if you have done your back-flush to get rid of it, you don't have to estimate the reliabilities all that accurately.

MR. SCOTT: But using this approach, you are not going to get to a point where you say for a large break, the sump won't work.

CHAIRMAN BANERJEE: Yes. You cannot do that.

MR. SCOTT: You're having some relaxations in the way you reached the conclusion that it will work.

MR. DINSMORE: And then I think they would have to come up with some reasonable reliability estimate that --

MR. SCOTT: That's true. They could calculate a delta risk.

MR. DINSMORE: Yes.

MEMBER SHACK: So this is related to risk-informed. We've already shown in the risk-informed, you can assume the sump is gone, doesn't work. You can still meet that.

MR. COLLINS: You can't meet defense-in-depth.

MEMBER SHACK: You can't meet defense-in-depth, but, then, how do you quantify that defense-in-depth? You were talking about --

MR. DINSMORE: Well, it is one of the five principles.

MEMBER SHACK: Yes, but how do you quantify it?

DR. WALLIS: Yes but --

CHAIRMAN BANERJEE: You don't quantify it.

MR. DINSMORE: Normally you don't quantify it. If you could quantify it, we would put it in the risk calculation.

DR. WALLIS: Well, if the sump clogs, you know you don't meet it. But if it partly clogs, there's no way of evaluating that.

MR. SCOTT: Well, if it partly clogs and it passes adequate water, it's --

MR. COLLINS: It's okay.

MR. SCOTT: -- it's successful.

MR. COLLINS: Yes.

MR. SCOTT: It either keeps the core

cooled or it doesn't.

DR. WALLIS: If you can demonstrate. Okay.

MR. SCOTT: Well, I mean, that's the exercise here, is the testing is to demonstrate --

DR. WALLIS: Any probability of the large break. That's irrelevant.

MR. SCOTT: The baseline resolution approach for this issue is deterministic.

DR. WALLIS: So, really, what you have to demonstrate is not these. You have to demonstrate that it will work.

MR. SCOTT: I think this was intended, Tim, was it not, this second bullet here, second sub-bullet, was to refer to if they implement this, then going forward, if they want to do something else, they have to evaluate it?

MR. COLLINS: No, no even. Whatever they do for the purposes of GSI-191 --

MEMBER ABDEL-KHALIK: Even if that is the only thing.

MR. COLLINS: As I'm saying, the assumption here is they're not doing anything but trying to satisfy GSI-191 by taking advantage of the relaxations.

CHAIRMAN BANERJEE: But there would typically be some form of recovery measure, though.

MR. COLLINS: And they could take credit for that.

CHAIRMAN BANERJEE: Yes.

MR. COLLINS: In a risk-informed implementation, they could take credit for that recovery action.

CHAIRMAN BANERJEE: Yes. But I guess what we were sort of grappling with was could the sump be much smaller in some sense than you would need to completely assure yourself that with the sump screen, that you would get adequate flow for the largest breaks?

So you've got this huge debris loading. It's arriving in the sump. You have to have a large enough sump screen that you will still get adequate flow.

The issue was, I suppose, the one in my mind, could you make a sump somewhat smaller for this very large break of the large-break LOCA so that there was some probability that the sump would work or wouldn't work? But I guess that's not it.

MR. COLLINS: If a licensee showed adequate performance using the existing criteria for the design basis below TBS breaks, show adequate performance, and they show adequate performance with the relaxed assumptions that would be potentially used above TBS and then they said, "Well, let's see here. What if I put some more insulation in the plant or," like you said, "I make the sump smaller"?

Then there would be a potential with the way this might play out where they could support a smaller strainer size or a larger debris loading. We can't rule that out. It's whatever they would come in with. And would it be supportable?

I think that the context that this discussion is occurring with is, can the licensee use these relaxations to show that whatever they have now is adequate, not to go put more in or make the strainer smaller, although I can't say they wouldn't propose that because the large strainers are a big operational issue.

You've seen them, I think. Some of them stretch all the way around the containment. They're a real pain to deal with. And they need to make sure they don't get damaged during the outage and all of that. So, you know, it is not beyond the realm of possibility that a licensee could use this to come in and try to make a change of that sort.

MEMBER SHACK: In practical terms, they have to deal with the phenomenological uncertainties, which it is very difficult to make these models --

MR. COLLINS: Right.

MEMBER SHACK: -- any more accurate than they are. And so I would think that most of the options here would be to use some other kind of equipment, the black-flush or something, you know, that --

CHAIRMAN BANERJEE: Some recovery measure.

MEMBER SHACK: I mean, it would be crediting recovery measures more than it would be somehow refining the phenomenological model for sump plugging.

MR. SCOTT: They may try to -- well, here we --

MEMBER SHACK: They could try.

MR. SCOTT: -- agree with you, but they could try that. And they might well. But because of all the factors you cited and we cited, that would be a complex undertaking. And we don't know how it would come out. And that I think is viewed by the industry as a disadvantage of this approach. They don't know how much benefit they'd get from it.

MR. COLLINS: Unless they could come up

with recovery actions that they like.

MR. SCOTT: And can show they work.

MR. COLLINS: And can show that they work, right.

CHAIRMAN BANERJEE: Okay. Let's go on.

MR. COLLINS: Okay. Just one other thing I wanted to point out in the last bullet here, that the injection phase ECCS models and analyses would at all be impacted if a licensee wanted to just supply the GSI-191.

And subsequent plant changes that would be made, unless they're taking advantage of the relaxation in 50.46a do not have to be risk-informed. So they could just continue making the other plant changes the way they always have in the past.

Now, there are a couple of other ongoing requirements that get carried along in 50.46a. Now, once a licensee adopts it, every four years, they have to reconfirm that changes that they made to the plant have not invalidated the technical basis for the rule, the applicability of the elicitation report, and the applicability of the seismic report.

We don't expect that will be too complicated of a process once they have gone through it originally, but they will need to do that every four years. And they also need to monitor the availability of any non-safety equipment that is credited for beyond DBA analyses because the rule limits operations in an unanalyzed condition to 14 days in any 12-month period. So they would have to monitor any non-safety equipment for its availability.

Okay. Slide 12. The schedule for 50.46a, we're scheduled to go to the Commission this December. And we would plan to issue implementing guidance about a year after that, after approval by the Commission to go forward with the rule.

The Commission typically takes a couple of months to deliberate on things like this. So it would probably be a year from next spring or something before the guidance would be entered. Okay.

That would be consistent with our recommendation to do the larger breaks in the longer term anyway. So it would satisfy the staff's recommendation.

DR. WALLIS: I may be wrong, but it seems to me that the risk-informed doesn't buy anything because the other risk criteria is always met because the probability of the big break is so small. They still have to show that the situation will cool it off.

MR. COLLINS: Yes, they do.

DR. WALLIS: So what is being gained?

MR. COLLINS: They may be able to do that using non-safety-grade equipment.

DR. WALLIS: One of two things can add to it?

MR. COLLINS: Yes.

DR. WALLIS: There's nothing they can do about the debris and all the stuff we talked about this morning?

MR. SCOTT: They might. They might be able to get some relaxation in the assumptions that are made with regard to transport and generation of debris.

DR. WALLIS: That is also debatable at the moment.

MR. SCOTT: It's uncertain how that would play out, yes.

CHAIRMAN BANERJEE: Well, for example --

MR. SCOTT: You are always thinking about it.

CHAIRMAN BANERJEE: -- if a sump clogs, they could put the flow through another screen or something.

DR. WALLIS: What has that got to do with the risk-informed?

CHAIRMAN BANERJEE: No. I mean, that could be a recovery measure.

MR. COLLINS: It wouldn't be safety-grade anymore.

DR. WALLIS: It wouldn't have to be safety-grade. Okay.

MR. COLLINS: It wouldn't have to be redundant. It wouldn't have to be safety. You wouldn't have to use --

CHAIRMAN BANERJEE: They could fit something on which was not safety-grade.

DR. WALLIS: Okay. Thank you.

MR. COLLINS: So, in summary now, our risk-informed considerations, we believe that the sump issue remains a safety issue for those plants that haven't demonstrate their strainer performance.

We believe that the recommendation in the SECY is risk-informed and it's consistent with the bible on risk-informed things, reg guide 1.174. And it also accounts for the limitations in the phenomenological knowledge that we have, difficulty in modeling some of the most important phenomena. And it is also consistent with the current thinking on risk-informing the ECCS requirements, the proposed

50.46a rulemaking. Okay?

We think that 50.46a could help facilitate the large-break LOCA resolution, but we don't think that it's an analysis-only solution, that there is still likely going to have to be more testing by the licensees and probably insulation removal or replacement.

And, of course, all risk-informed implementation is going to be dependent upon the Commission's decision on the 50.46a rulemaking. If they should trash 50.46a --

MR. DINSMORE: Or change it.

MR. COLLINS: -- or change it, then we'll have to revise our guidance in accordance with your decision.

MR. DINSMORE: If they should decline to issue it.

MR. COLLINS: Right.

DR. WALLIS: 40.46a decisions should not be influenced by GSI-191. It's not the key to resolving this GSI.

MR. COLLINS: No. Basically it's a business decision for the industry. If 50.46a should get issued, they are going to have to decide what is the most advantageous business decision for them. Is it 50.46a or is it something else?

CHAIRMAN BANERJEE: Well, it certainly gives them flexibility to handle the largest breaks. If you think your way through this, you might find a lot of ways to take advantage of that.

MR. SCOTT: And we don't know. It definitely provides flexibility. The amount of benefit to be gained from that facility is not as clear.

CHAIRMAN BANERJEE: No. But that's up to them to figure it out. Right? I mean, if it comes to that --

MR. SCOTT: I'm sure NEI will be happy to share their perspective on that with you this afternoon.

CHAIRMAN BANERJEE: So do you want to go on to your summary now or later?

MR. SCOTT: We can do that. It will only take ten minutes to go through it.

CHAIRMAN BANERJEE: Let's do it. Yes. Then we will be running half an hour later at that point.

MR. SCOTT: Half an hour late? I thought we were early.

CHAIRMAN BANERJEE: No, not you. I mean

the meeting. I thought we were supposed to --

MR. SCOTT: I thought we had three hours.

CHAIRMAN BANERJEE: It was changed.

MR. SCOTT: You're right. You're right. I'm half an hour late.

CHAIRMAN BANERJEE: That's all right.

MR. SCOTT: My mistake.

CHAIRMAN BANERJEE: Go ahead.

MR. SCOTT: This will be really quick. Come on up, Chris.

CHAIRMAN BANERJEE: Thank you very much.

MR. HOTT: Staff believes GSI-191 remains a safety issue for unresolved plants. It's because of the high consequence potential sump clogging. Core damage may occur as a result of the event alone with no additional system failures and that a mitigation system like containment spray could also be affected; staff-recommended approach for to maintain the current integrated review process; revisit GSI-191 risk tools for evaluating larger breaks; set risk-informed schedules for resolution; and resolve in-vessel effects as part of GSI-191.

The recommended approach provides a near-term resolution for the most significant smaller loss-of-coolant accidents.

DR. WALLIS: Now, wait a minute. You say remains a safety issue. It means it remains a compliance issue, doesn't it? The amount of safety involved is not very big.

MR. SCOTT: We don't agree that that is clearly the case. Again, if you just focus on the largest breaks, then the probability is small. The risk is less. But we do not believe that for the plants that have not yet resolved this issue, that they have shown that it is not a safety issue. We simply don't agree with that.

DR. WALLIS: So it is a safety issue, not just a compliance issue?

MR. SCOTT: Yes.

DR. WALLIS: There is not much safety significance, as a safety issue?

MR. SCOTT: Again, the issue here for the breaks, not the very largest of breaks, the probability is not such that we can ignore that the break could happen.

If the break does happen and the -- well, we're not ignoring them anyhow. I'm getting crosswise of myself. But if a break were to happen and the sump performance was demanded, then we would not have a reliable demonstration that the sump would perform.

If the sump does not perform, then core damage could follow. And at the same time, the mitigation feature of containment spray would also be impacted by this and that for those reasons, we believe that it is a safety issue.

DR. WALLIS: But the reason that it doesn't have to be resolved today is because the safety implications are small.

MR. SCOTT: It's not that they are small, but we believe that they are acceptable for the near term to get the issue fixed.

MEMBER CORRADINI: I guess Graham is asking a question that has been bothering me from the beginning. So you're kind of splitting this a bit finer than I would. Either it's a compliance issue and although there are safety questions, they're small enough that they hold in the compliance zone versus something is out of compliance enough that you have to stop something.

And it seems like Graham is asking you it's either black or white, and you're telling us a gray. I'm still trying to understand your answer to his question.

MR. SCOTT: Not every safety issue requires an immediate, for example, decision not to operate plants anymore. We're saying that this issue is of sufficient safety concern that it needs to be resolved.

We do not believe it is of such imminent concern that we need to question whether the plants can continue to operate while we resolve the issue. It is gray in that sense.

CHAIRMAN BANERJEE: But it is also true that we have taken action by increasing the sump screen areas, which have dealt with the immediate problem of the very, very undersized sumps. So it's improved the likelihood that we have less of a safety issue.

MR. SCOTT: The situation --

CHAIRMAN BANERJEE: We haven't demonstrated it.

MR. SCOTT: The situation is better now than it was in 2004, --

CHAIRMAN BANERJEE: Right.

MR. SCOTT: -- when the generic letter was issued. On the other hand, some effects whose impacts were not clearly known in 2004 have turned out to be potentially problematic here.

CHAIRMAN BANERJEE: Sure.

MR. SCOTT: So those effects, the fact

that several of the presenters have referred to where a little bit of debris can go a long way, this stuff, this material, does not behave well. Therefore, we continue to believe it is of concern.

And we believe that we have developed an approach that is intended, recognizing that it has been out there a while, it has been out there a while, but we have proposed something to the Commission that will make it go away in what we consider to be a reasonable period of time.

And that is a judgment call. And that is our judgment.

CHAIRMAN BANERJEE: Does that satisfy you, Mike?

MEMBER CORRADINI: It helps. I am just simply following up Graham's question because I was listening to that answer.

CHAIRMAN BANERJEE: Okay. Let's go on.

MR. HOTT: All right. The recommended approach here by the staff is intended to provide near-term resolution for more significant, smaller loss-of-coolant accidents while allowing additional time for refinements for evaluating larger breaks; maintain sufficient defense-in-depth by requiring mitigation for all size breaks; and incorporates risk insights, both in the implementation schedule and the in the analysis of larger breaks; continues the integrative review process, which has been successful for the majority of PWRs in answering all strainer questions; and balances conservatisms against potential uncertainties.

The implementation schedule also takes into account the amount of planning and effort required for licensee implementation of ALARA methods to reduce the doses of additional modifications.

MEMBER ABDEL-KHALIK: All of this, of course, is provided that there are no surprises for the downstream effects?

MR. SCOTT: Well, there is always the possibility of a surprise. And we will adjust the resolution schedule in the plan as needed if those things should occur. Again, we anticipate the in-vessel effects testing is going to wrap up this month. And if something unexpected happens, we will have to respond to it.

MEMBER ABDEL-KHALIK: But your presentation to the Commission will precede that conclusion?

MR. SCOTT: No, I don't think that's correct. The Commission meeting is September 29th.

MEMBER ABDEL-KHALIK: Right.

MR. SCOTT: The cross-test is this Friday. And then we have asked for one more low-flow test, which we anticipate would happen before the 29th.

Now, we won't have the written report by then, but we will have the answer by the time we sit before the Commission unless something --

CHAIRMAN BANERJEE: Now, we have to also go in front of the Commission with you.

MR. SCOTT: Right. Looking forward to it.

CHAIRMAN BANERJEE: So would we have that information, too?

MR. SCOTT: I would be more than happy when we get the information to share it with you.

CHAIRMAN BANERJEE: That would be very useful.

DR. WALLIS: What are you doing about the test which showed that the fewer particles you have, the worst the ⌂P so that if you extrapolated, you assumed having no particles at all is the worst case? How do you deal with something like that?

MR. SCOTT: The particle-to-fiber ratio of one-to-one is considered to be the lowest that could be attained.

DR. WALLIS: Why?

MR. SCOTT: Simply because anything less than that, it's approaching what you're talking about, where there is just nothing in the plant.

DR. WALLIS: Yes, but --

DR. KRESS: It has to turn around.

DR. WALLIS: How do you know where it turns around? I mean, that's a simple question. Have you ever tested something in that region to be sure that it does turn around?

MR. SCOTT: Again, staff does not believe that less than one-to-one is attached.

DR. WALLIS: I don't accept the staff does not believe --

MR. SCOTT: I understand that. We will get you an answer that you would find --

DR. WALLIS: Belief is no substitute for data.

DR. KRESS: This ratio of one-to-one, is that a mass ratio?

MR. SCOTT: Do we have somebody in the audience? Steve Smith, can you answer that?

DR. KRESS: Because it may not be the wrong thing to deal with.

MR. SMITH: Yes. Steve Smith. It is a mass ratio.

DR. KRESS: Yes.

MR. SMITH: It's based on the mass.

DR. KRESS: So the one-to-one really doesn't mean much in terms of area blocked or how you lay the stuff together to block up the filter. It has to be something besides mass, I think. These are those things. They're a lot different than that. But one-to-one just --

DR. WALLIS: There's nothing magic about --

DR. KRESS: Not magic. That was I think Graham's --

DR. WALLIS: So you are going to resolve all of this this month sometime with us?

MR. SCOTT: Not with the ACRS. We are meeting with the ACRS in October.

DR. WALLIS: So you want us to write a letter after you've --

CHAIRMAN BANERJEE: We have to write a letter.

MR. SCOTT: Your choice to write a letter is yours.

CHAIRMAN BANERJEE: Right.

MR. RULAND: That's the ACRS' choice to write a letter.

DR. WALLIS: I'm just expressing skepticism that you are going to resolve the downstream effects satisfactorily without telling us exactly what that advice is involved in that.

MEMBER ABDEL-KHALIK: Well, I guess the only thing we can state is that this is all contingent on resolution of the downstream effects issue.

DR. WALLIS: Questions remain.

MEMBER ABDEL-KHALIK: Right.

DR. WALLIS: Yes. We can say that.

CHAIRMAN BANERJEE: I think let's go through the summary slides. Let's finish them.

MR. SCOTT: I would also submit that, regardless of how that plays out, you would be able to weigh in if you chose to on the distinction between several of these options that are presented here.

MEMBER ABDEL-KHALIK: Right. Comments on leak-before-break, for example, --

MR. SCOTT: For example.

MEMBER ABDEL-KHALIK: -- GDC.

MR. SCOTT: Yes.

MEMBER ABDEL-KHALIK: Absolutely.

CHAIRMAN BANERJEE: Yes. I think we need to try to conclude.

MR. SCOTT: Yes. Go ahead.

MR. HOTT: This is the final slide. The staff is now recommending leak-before-break credit would be inconsistent with GDC-4, defense-in-depth principles, and the proposed 50.46 alpha risk-informed rulemaking for ECCS.

LBB credit for global effect might set a precedent for other areas of plant design. And the staff has continuing concerns with PWSCC.

That's the end of the presentation.

CHAIRMAN BANERJEE: I have one question. The SRM also asked for BWRs, if I recall.

MR. SCOTT: The SRM asked the staff for my information to the Commission.

CHAIRMAN BANERJEE: Was that on a continuing basis, not in the SECY? I forget the wording there.

MR. SCOTT: We're going to address it, at least in the near term, with a correspondence with the Commission on the subject.

Of course, as you know, we updated them on it in the April meeting.

CHAIRMAN BANERJEE: Right.

MR. SCOTT: Just for your information, we are in the middle now of some detailed discussions with the BWR owners' group about different aspects of the problem that pertain to BWRs.

CHAIRMAN BANERJEE: I think somebody from your staff asked us informally if we wanted to be informed about what is going on there. Now, I have forgotten who it was, and it was about a month or two ago.

MR. SCOTT: We would be happy to let you know. Basically, we have one two-day meeting a month. We had one last month. We have one this month and the next two months to discuss particular subject areas that we have expressed questions to them about as to whether given what we have learned from the PWRs, that there needs to be a new evaluation for BWRs.

The owners' group, to their credit, is attempting to address these issues and get out ahead of us. And so we are interacting with them to make sure they answer the right questions.

CHAIRMAN BANERJEE: Okay. So, with that, I think what we will do is -- thank you very much for a very informative set of presentations. And we will take a break and then maybe have NEI followed by STP or which order would you like?

So we are running about half an hour late, but that is not unexpected. So we will take a

15-minute break and be back at 4:15. Thank you.

(Whereupon, the foregoing matter went off the record at 4:00 p.m. and went back on the record at 4:15 p.m.)

CHAIRMAN BANERJEE: We are back in session. We are going to hear from John Butler, NEI, first. Go for it, John.

MR. BUTLER: All right. I welcome the opportunity to speak for this subcommittee and my name again is John Butler with NEI. With me up here is Tim Bowman, who is the General Manager of Oversight at South Texas Project.

So I am going to go through some perspectives, considerations on the options presented in the SECY paper and Tim is going to go through from a plant-specific standpoint application of the various options at South Texas Project. So I will get started.

You have already gone through this with the staff presentations. This goes through the resolution options that were considered in SECY-10-0113, which I will refer to as the Options Paper.

Option 1 provides considerations of schedule. Option 2 is where the staff lays out a couple of risk-informed options. And then Option 3 is consideration of GDC-4, which I will go through in a little bit more detail because I consider it the original risk-informed option.

But in the end, the staff recommended Option 1.b, which is considering the small break spectrum on a near-term schedule, longer term larger breaks on a schedule as informed by the risk-informed in Option 2. So they recommended Option 2 and Option 1.b.

The industry recommendation, which I will just jump to the bottom line, which is we recommend, and we are in agreement with the staff, we recommend Option 1.b in looking at we need to address the smaller breaks, the more risk-significant spectrum of breaks in a deterministic fashion, in a method that the staff finds to be acceptable. We need to do that on a schedule as quickly as possible. We want to close out that spectrum of breaks.

For the larger breaks, the less safety-significant spectrum of breaks, we would like to expand our options, look at the risk-informed options in 1.b, I mean in Option 2, but also to give consideration to Option 3. The one thing that hasn't, I guess, been stressed here, is this is not a one size fits all issue. It never has been. It never will be.

So I would like some consideration of Option 3, in general, to make sure we are clear and understand what the rule allows, what it doesn't allow. But there needs to be a realization that some plants may prefer Option 3, if it is allowed. Some plants may prefer Option 2, 50.46a, if it is allowed, because there are some advantages there but there are also some clear disadvantages. But it is going to vary from plant to plant what is the most appropriate options.

Other plants, as has been pointed out, don't need any of these risk-informed options. They are basically ready to close it out now as quickly as they can. So we have 69 PWRs and they run the gamut, the spectrum in terms of where they stand with this issue and what they see as the most expedient way to close this out.

CHAIRMAN BANERJEE: Would Option 3 allow you recovery actions as well? You don't have to consider them. Is that it?

MR. BUTLER: Well, a lot of us have been talking about --

CHAIRMAN BANERJEE: Because there are --

MR. BUTLER: -- the differences between GDC-4, LBB and 50.46a, as in 50.46a, you have to demonstrate mitigation capability.

I imagine you can, this is up to the Commission, you could implement GDC-4 with some expectation that there be some capability to demonstrate mitigation capability, similar as what was done with the original bulletin response to show that there is a building to protect, blockage when it occurs. What are the operator actions when it occurs? What actions would they take? What effectiveness would it have? The biggest difference between doing it ala the bulletin-type response, what is your compensatory measures or mitigation measures that way, between that and 50.46a is probably the level of vigor that would be required in that analysis. But again, you could do something along the lines of providing some assurance beyond just saying it is not going to occur. You can go beyond just pointing to the likelihood of a break in that spectrum.

CHAIRMAN BANERJEE: Okay.

MR. BUTLER: Again, we would like the Option 2, risk-informed options -- Because this is not a one size fits all issue, we would like to pursue all these options. There are advantages to 50.46a that are not GSI-191 advantages. 50.46a was put forward not as a 191 change. It was to address some of the impacts of the traditional LOCA analysis and that is where the rule change is really focused. It is not a GSI-191 rule change.

If you look at the evaluation methodology and the acceptance criteria as they apply to GSI-191, there is really no difference between the greater than TBS evaluation methodology language in the rule and the acceptance criteria language in the rule between greater than TBS and less than TBS, as they apply to GSI-191 because not having to assume the loss of offsite power, not --

MEMBER SHACK: Single failure.

CHAIRMAN BANERJEE: Single failure. These have very little, if any, impact on GSI-191. So the advantage of 50.46a really comes from looking at the larger --

MEMBER SHACK: But non-safety equipment might.

MR. BUTLER: Yes. And even that varies from plant to plant. Some plants have a capability to backflush with existing configurations in a non-safety capability but some plants don't. Some plants have check valves there that their capability to blackflush is --

CHAIRMAN BANERJEE: How about non-concretely, these high fiber plants that are left, the

20 odd whatever, do they have, of these how many have the capability to backflush?

MR. BUTLER: To backflush, I really don't have that value.

CHAIRMAN BANERJEE: It would be interesting because in some sense we are talking of practical matters here. You know there are a certain number of plants left.

MR. BUTLER: Well --

CHAIRMAN BANERJEE: And you know we want to see what the application of 50.46a might to do those.

MR. BUTLER: Let me just speak, well I can't speak off the record but from my own --

CHAIRMAN BANERJEE: It's okay. We won't hold you to it.

MR. BUTLER: My own personal view here. Even plants that don't have that capability now, you know, say there is a check valve here, the impact of making design change to change out that check valve with a motor operated valve or some other valve may be less than the impact they would get into if they had to do a full installation change out in terms of dose impact and cost, which are both key considerations.

So you know, it is always possible to

always look at options. And if they have an option that provides them the same closure of an issue at a lower cost and lower worker dose impact, that is what they are going to pursue.

MEMBER SHACK: How about a non-safety way to refill the RWST?

MR. BUTLER: Well they have that now. That is pursued.

MR. BOWMAN: And most of us have it proceduralized.

MR. BUTLER: It is not anything that people credit.

MEMBER SHACK: Yes, but you get credit under 50.46a.

MR. BUTLER: Yes.

CHAIRMAN BANERJEE: But if your sumps clog, it may not do much.

DR. WALLIS: It helps for a while.

MR. RULAND: Maybe in recirculation.

MEMBER SHACK: I mean, that is the whole point is to avoid recirculation.

MR. BUTLER: All right. Option 2a wasn't discussed very much in the staff presentation but it was one of the options in the paper.

It is in place right now. It has been

limited in its use for several reasons. Some of them were mentioned but one of the main reasons it hasn't been utilized is it provides limited relaxation of conservatisms, limited relaxations of how you treat it currently.

You know, I will refer to this in this discussion and also the 50.46a discussion but there needs to be separation between the criteria that you apply to the small break spectrum and the criteria that you apply to the large break spectrum. Otherwise, you get no benefit from looking at this.

And until you get that separation, it is not going to be an option that is going to be pursued willingly because you are basically looking at it in the same fashion that you are looking at it now.

MEMBER SHACK: But isn't the more difficult one the first bullet, where you are trying to justify that relaxation in the -- I mean, we can all agree on what is conservative. Well, I'm not even sure we can agree on what is conservative, let alone agreeing on how much you can relax them.

MR. BUTLER: I see there are two -- I am getting ahead of myself but there are two main disadvantages I see with 50.46a. One is what we are just mentioning. It is going to be difficult to identify that separation between the criteria you applied for the large break spectrum and the criteria you applied to the small break spectrum.

The second disadvantage, one of the second key disadvantages is the difficulty in supporting any relaxation because, as was pointed out earlier, all the testing and analysis has been performed in a deterministic fashion to demonstrate that you are bounding something, that you are covering all possibilities. And so whether you agree that you have accurately bounded or not, that is what you are striving for and you have very little data and analysis on what is short of that.

So if you are looking at, you know, a more realistic scenario, not a bounding scenario, you really don't have any testing data to support that right now. So you are stuck defaulting back to that bounding scenario. And so that is going to inhibit getting any real separation between the small break criteria and the large break criteria.

DR. WALLIS: So to get a benefit, you would have to do a whole new series of tests on what you thought were the limiting amounts of stuff with a small break. Is that what you would have to do?

MR. BUTLER: Yes. I am trying to think of a good example of what I mean by that. In effect, yes. I mean, you would need additional testing or research to support more realistic analysis criteria.

CHAIRMAN BANERJEE: Well most of it is the amount of debris.

MEMBER SHACK: I mean, the settlement might be the one thing somebody could refine that analysis.

DR. WALLIS: Well, ZOI is a lot less, isn't it?

MEMBER SHACK: No, ZOI is not --

CHAIRMAN BANERJEE: Well it is just the amount of debris. So if you had to sort of look at the TBS as your divider and you apply the ZOI and everything which is done, then you know there is a certain amount of debris about which you can consider them large breaks and you have got some relief. It is fairly clear what you can do.

MR. BUTLER: We can take the ZOI testing as an example of what you might do.

CHAIRMAN BANERJEE: Yes.

MR. BUTLER: I mean, currently, to cover the full spectrum, and a lot of this conservatism is done, being imposed upon ourselves to simplify the number of tests that you have to perform. But you cover a spectrum of break sizes, a spectrum of break configurations, and you are trying to limit the total number of tests that you have to perform because these are expensive tests. But as a consequence, you assume an instantaneous break or a break that occurs very quickly such that you can potentially get some kind of pressure wave with that fast opening. Now that is possible for a smaller break but, you know, it is highly unlikely if not impossible for a full double-ended or a large bore pipe to open up fast enough to give you that pressurization.

CHAIRMAN BANERJEE: Does the ANSI standard require you to consider the blast wave? I thought it did not. I was looking at Ransom's write-up.

MR. BUTLER: I am just speaking from the testing. If you test, you know, something with a fast opening ruptured disk or something that opened up more reasonably because you are trying to -- It depends on whether you are trying to simulate the full spectrum of break possibilities or simulate what could happen for a large bore pipe, which would be your more realistic.

CHAIRMAN BANERJEE: Yes, I wasn't talking about testing. I was simply talking about the testing related to the strainer blockage. You could barometrically survey a range of debris loadings, which will cross the TBS. The TBS will give you your reference, if you like. And then that is what would be your debris loading for that break size. And then if you had more debris loadings, they would go more towards that break and you had more sort of scope of taking this recovery actions and things like that.

If they were smaller, you would be able to handle them anyway with the TBS so you wouldn't worry about that. So one could do some TBS testing, taking that size, and look at somewhat larger amounts of debris and see what mitigatory measures you could take, backlashing or whatever.

MR. BUTLER: Right. But this testing would likely have to be done on a plant-specific basis.

CHAIRMAN BANERJEE: Yes. Each plant is different.

MR. BUTLER: The recipe for each plant is different.

CHAIRMAN BANERJEE: So you get different amounts of debris and such.

Well, it is a complicated problem but you are in the process of doing plant-specific testing anyway.

MR. BUTLER: Right. Although some plants are, depending upon which of the risk-informed options or Option 3 that is utilized, they may not have to do additional testing. They may be able to rely upon the testing --

CHAIRMAN BANERJEE: They have already done.

MR. BUTLER: -- with just a small reduction in the debris loading.

CHAIRMAN BANERJEE: Anyway. Okay.

MR. BUTLER: Option 2b. The greatest value in 50.46a comes form the traditional LOCA changes that it would potentially allow. The real language in whether it allows for GSI-191 is somewhat limited. Because of that, the perceived value and benefit of 50.46a really is going to vary from plant to plant. A plant that is looking to apply 50.46a beyond GSI-191 would see a lot more value in that approach than a plant that would not be looking in that direction.

Because the rule is not final and we haven't gotten into any discussion on implementation guidance in general for the rule and implementation guidance for GSI-191 in particular, there is going to be some time necessary. That in combination with the uncertainty really raises some questions in my mind.

Option 3. This is the option that the industry has no doubt been pursuing. We see it as a way to address beyond what I characterize as the unlikely breaks. These are without a doubt a spectrum of breaks that occur at a very low frequency.

The application -- I see application of GDC-4 as not something that is limited to those plants that haven't closed it yet. One of the difficulties with the methodology that we are using to close GSI-191 is it not a methodology that allows you to evaluate impact of future changes or future questions that come up, without going through the process again or doing additional testing.

I have referred to this jokingly as the Snicker bar wrapper issue. I mean, if you are in a containment and that you find at the closing of the containment a Snicker bar wrapper, well your debris generation calculations and analyses and testing didn't take into account a Snicker bar wrapper as being part of your debris source. What do you do?

So, GDC-4 would provide all plants the capability to address those type of unexpected instances in some way.

DR. WALLIS: I thought the GDC-4

application was to simply say that beyond the LBB piping, didn't need to be considered.

MR. BUTLER: No. GDC-4 allows you to exclude local dynamic effects from --

DR. WALLIS: But that is --

MR. BUTLER: But that is the majority of it. But even for the LBB piping, you need to consider the global effects which would still contribute to debris, in the sense of unqualified coatings, latent debris.

Now, I am not saying that they would be in any way limiting. In applying GDC-4, you would likely be limited. Your limiting debris generation would come from probably your largest non-LBB pipe but you still need to consider the LBB debris generation, after you have excluded the local dynamic effects.

DR. WALLIS: Never mind.

MR. BUTLER: Okay.

DR. WALLIS: I don't quite understand but that's okay.

CHAIRMAN BANERJEE: Well, it is clear it was there to allow you to do inspections more easily.

DR. WALLIS: Well, I know. I know that. I know that. I am just trying to figure out how you see it being applied to the GSI-191, how you would like to see it apply.

CHAIRMAN BANERJEE: Local dynamic effects is LOCA generation of debris. Right?

DR. WALLIS: So if we decree that there is no generation of debris from --

MEMBER SHACK: There are no breaks.

CHAIRMAN BANERJEE: There are no --

MEMBER SHACK: -- hit by another break.

DR. WALLIS: That is what I thought was the idea.

MR. BUTLER: I mean, you are right. If you postulate a break in a LBB pipe, you would exclude the debris generation from the jet impingement from the break in that pipe but you would still need to take into consideration the global effects, which would come from the wash down of latent debris in the containment, unqualified coatings that are falling off because of the high pressure temperature --

DR. WALLIS: -- of the idea that you can strip off the coating but you can't strip off the insulation. That seems to be inconsistent.

MEMBER ABDEL-KHALIK: That is sort of how a lawyer would interpret GDC-4, rather than someone who looks at the original intent of GDC-4 would get into.

MR. BUTLER: Let's get into that. I mean, one of the things I brought for a handout is the *Federal Register* notices for the original LBB rule, the expansion of the LBB rule and then a request for comment on further expansion.

I encourage you not to take my word on it, not to take the staff's word on it but read it yourself. It is not a long read. I encourage you to read that.

Now the rule allows use of qualified piping to exclude local dynamic effects from the design basis. It doesn't say exclude local dynamic effects for application here but not here.

MEMBER ABDEL-KHALIK: The rule may say so in words but what is the intent of the rule, as stated in the statements of consideration?

MR. BUTLER: Well, the intent of the rule came about recognizing that there are adverse consequences of assuming the full design basis consideration of these large, unlikely breaks. So by excluding local dynamic effects, that allows people to remove the jet impingement shields and pipe whip restraints that were impeding inspection and caused a lot of high dose.

So they recognized there is a safety

worker benefit to applying this rule change to allow the removal of those jet impingement shields and pipe whip restraints. So that would allow the inspection of the piping to occur easier with lower dose. And you get an actual safety benefit there because of improved inspection.

DR. WALLIS: But there is nothing there about long-term cooling though. It is a totally different issue, isn't it?

MR. BUTLER: Well, they recognize that by excluding the local dynamic effects that provided an inconsistency between that and the ECCS criteria, 50.46, which brings a long-term. They acknowledge that. And they basically came out, we are going to allow you to exclude the local dynamic effects but not the global effects.

And they go through and actually identify what the global effects are. For containment, it is the pressure and temperature. For ECCS it is the flows and --

DR. WALLIS: Assuming there is a big break.

MR. BUTLER: Pardon me?

DR. WALLIS: Assuming there is a big break then?

MR. BUTLER: Yes.

DR. WALLIS: It just doesn't make any sense to me.

MR. BUTLER: Well again, that is the reason I brought the *Federal Register* is to allow each of you to read through the intent of the rule as --

CHAIRMAN BANERJEE: I think we read it carefully. The summaries don't reflect that but we could go through all the wording and try to understand if there was -- what was the intent and how it plays out.

So let's table this. We have got it. Everybody has it. And let's move on, otherwise we get stuck.

MR. BUTLER: All right. Now Option 3, again we have been pushing that. There has been a lot of -- This was addressed in the staff's presentation with reasons why we don't see GDC-4 being applied.

What I have done in the next few slides is tried to kind of push back on some of those reasons that I disagree with in some degree disagree with. The first reason was that application to LOCA-generated debris is not the intent of the current GDC-4 rule. The intent was to allow the removal of the jet impingement shields and pipe whip restraints by allowing the exclusion of the local dynamic effects. It didn't get into the applications of the rule after you have excluded those local dynamic effects. You now, there are a number of applications of GDC-4 that aren't explicitly mentioned in the rules. So, it is a little difficult for me to --

CHAIRMAN BANERJEE: Well the rule and discussion in the *Federal Register* specifically seemed to address pipe restraints and things. So are there applications of the rule that you are aware of beyond what is in here?

MR. BUTLER: Well, --

CHAIRMAN BANERJEE: Because we can read what is in here.

MR. BUTLER: By taking out the pipe whip restraints and jet impingement shields, it allows you to exclude those local dynamic effects in some of the design analyses. Those design analyses applications of that exclusion of local dynamic effects are not addressed in the rule. The rule said you can exclude these local dynamic effects.

Now given that you have now excluded those local dynamic effects, how do I utilize that? Now, that has been utilized in in-core analyses in terms of structural effects on fuel and vessel internals. It has been used in impact on equipment. It has been used on the strainer to exclude jet impingement on the strainer directly.

DR. WALLIS: I don't understand this, though because emergency core cooling is not inferenced by this modification. So you still have to consider large break LOCAs. Right? Under LBB, you still have to consider large break LOCAs.

MR. BUTLER: Right.

DR. WALLIS: Well if you do have a large break LOCA, there is going to be a zone of influence. You can't say there isn't.

If you have to consider large break LOCAs, then you must consider their effects.

MR. BUTLER: You are looking at this rationally and GDC-4 is not rational, unless you introduce an inconsistency. So I am not going to try to convince you otherwise.

But GDC-4 has been allowed to exclude the impulse forces, asymmetric loads from a break. You can ignore those but they are there.

DR. WALLIS: The idea must be that that doesn't really affect something what matters like core cooling.

MR. BOWMAN: No but it affects the core --

MR. BUTLER: It affects the core.

MR. BOWMAN: -- the rods going inserted into the core.

MR. BUTLER: I mean, if you want to -- Every application of GDC-4 probably with no exception, every application of GDC-4 affects safety to some degree. And that has been one of the arguments here and it affects defense-in-depth to some degree.

You know, the structural capability of the core itself is probably not something that I want, you know. That is a single point of vulnerability right there.

CHAIRMAN BANERJEE: Well in fact, issue three here says, "The Commission acknowledges that this rule making will introduce an inconsistency into the design basis by excluding only the dynamic effects of postulated pipe ruptures, while retaining this postulated accident or . . ." And I didn't see core cooling systems, containments, and environmental qualifications.

So I think they make it very clear that this is nothing, does not impact emergency cooling or containment or anything else. It only effects --

MR. BUTLER: The third Federal Regulation rules I provide there, they go into a little bit more detail. It may be in the second one, too, where they identify what the global phenomena are that they retain. And they identify that for containment ECCS and EQ.

CHAIRMAN BANERJEE: But again they say for the present. The full rule allows the removal of plant hardware, which it is believed negatively affects plant performance while not affecting emergency core cooling containment, environmental qualification, or mechanical, electrical, blah, blah, blah.

MEMBER SHACK: I think his lawyerly argument is that the dynamic effect is the blowing off of this debris.

CHAIRMAN BANERJEE: That's right.

MEMBER SHACK: The heat removal, you know, the amount of water you need for that is --

DR. WALLIS: You are going to assume there is a big LOCA and it doesn't generate any debris. Is that what you want to assume?

MR. BUTLER: I am saying that for the design of ECCS, in terms of mass flow heat removal requirements, I am assuming the full spectrum of breaks, including the full double ended guillotine rupture of the largest bore piping.

MEMBER SHACK: But even as a lawyer, you have got 25 years of precedent against you is one of the problems.

MR. BUTLER: I don't follow you there.

MEMBER SHACK: I mean, nobody has applied it to this problem until now.

MR. BUTLER: That is not precedence. It is just lack of application. It doesn't say that the fact that you didn't apply it from day one that it wasn't something you could apply.

CHAIRMAN BANERJEE: But I guess we are not lawyers here. The reality of the situation is that we have seen happenings in Barsebäck, Perry, Limerick, all over, where there have been relatively small events --

MR. BUTLER: Exactly. And as I point out from the start here, we agree with the staff that for the risk significant spectrum of breaks, breaks that have the potential to occur with some likelihood above mixed fuel that we should address that in a deterministic fashion using methods that the staff is agreeable to. We are not arguing that with the staff.

MEMBER ABDEL-KHALIK: It is, of course, very difficult to second guess people's thinking but it is reasonable to say that it would have been impossible for the people who approve this rule to have thought of all the potential scenarios in which it may apply.

So the question is, had this been posed to a reasonable person at the time, that this would lead to potentially plugging of the screens as a result of a LOCA if they would have gone ahead and approved this.

MR. BUTLER: From a risk standpoint, that is what they are taking into consideration. You could ask the same question for every application that has been applied from day one.

MEMBER ABDEL-KHALIK: Yes, I agree. And it is very difficult. So the question before us is if we were put in that situation, would we have approved it. And that is the judgment that we have to pass.

MR. BUTLER: It's a good thing this is a question that is being asked of the Commission. They will answer this question.

MEMBER ABDEL-KHALIK: Absolutely.

MR. BUTLER: What I am trying to impress upon anybody who will listen to me is that this is not a case where the rule language itself says thou shalt not do it this way. You know, at a minimum, it is subject to interpretation.

MEMBER ABDEL-KHALIK: True. Because it would have been impossible for people to predict all the possible potential applications.

MR. BOWMAN: We are just bringing up that this is a possible application of this based on --

MEMBER ABDEL-KHALIK: I understand.

MR. BOWMAN: And we understand it. We are just trying to put forward that there is obvious inconsistencies that it brings up and saying this is a possible application. And because, frankly, as a licensee and when I get to speak here in minute, I am looking for ways that I can resolve this and get this resolved because we want to resolve it. So we are looking at, what do we think is the best expedient dose, cost regulatory solution. And we are saying we think this may be one.

MEMBER ABDEL-KHALIK: But you know, from my perspective, my job is to protect the health and safety of the public.

MR. BOWMAN: So is mine.

MEMBER ABDEL-KHALIK: And the question I ask is whether this will enhance or deter the health and safety of the public.

MR. BUTLER: Any risk-informed option is going to have a safety impact. Anything that you are doing that is something less than the full deterministic option is going to have a safety impact. At some point you are going to take into consideration not just, you know, that it is going to have safety impact, but is that safety impact small enough so that --

MEMBER ABDEL-KHALIK: I guess I don't really need to get into a philosophical discussion with you. So, I would urge you to continue.

DR. KRESS: We basically had that philosophical discussion earlier this morning. So it has already been accepted as a philosophical purpose that you can increase the risk.

MR. BUTLER: And I think that to take some of the impacts of this and mark them against 1174 criteria, that would be acceptable.

I am going to skip, you know, get through this a little bit quicker.

CHAIRMAN BANERJEE: Yes, I think we should move one.

MR. BUTLER: Yes. I think trying to flush back events, that this is, as was put in the staff presentation, a significant reduction in defense-in-depth.

Two points. It is difficult for me to see how they determine that it is a significant reduction in that there is no really measure of defense-in-depth and how do you, unless any reduction is a significant reduction.

The other point I would make is that any risk-informed option, to some degree, is a reduction in defense-in-depth. There is going to be some likelihood that you are going to block the strainers.

CHAIRMAN BANERJEE: And then it was over.

MR. BUTLER: Yes. So, I can't argue that there is not a reduction in defense-in-depth applying GDC-4. I argue with how it is portrayed.

CHAIRMAN BANERJEE: I think that if you had a means -- Let's say you did block the strainers but there was a means of recovery from that. That would be different, you know. And that is sort of what 50.46a allows you to do because it allows you to take into account non-safety systems, which will allow you to recover. And that, I think, would give everybody a lot of confidence. Because once you block the strainer and you can't recover, then things get pretty bad. That is the real problem.

If it happens, you know, and you cannot recover, even if large breaks are very unlikely and so on, you all agree that 50.46a, CRS, you know, we will flow with it and so on. So now you want to use that, use a little probability, use non-safety equipment, gives you a lot of flexibility to do things.

MR. BUTLER: Having the capability to act, as you say, if you have blockage, having some capability even if it is non-safety, even if it doesn't occur with a hundred percent reliability, I think that would be excellent. A lot of plants do have the capability to have a limited backflush, if you will from their RWST, and rethink it somewhat and do routing, which is some plants are easier to get to than others, have flowed back through the strainers.

CHAIRMAN BANERJEE: And that is not the only way. I mean, you could have many other, if you sat down and thought about it.

MR. BUTLER: Right. And from a GDC-4 point of view, you could probably point to a number of capabilities that you have along those lines. Where you have difficulty in 50.46a is demonstrating the effectiveness of that capability to the satisfaction of the staff, through testing. I am sure that that plant that has a backflush capability would be able to fully credit that backflush capability because of the difficulty in demonstrating to the staff's satisfaction the effectiveness of that backflush under all conditions.

CHAIRMAN BANERJEE: Or it could lead to other problems.

MR. BUTLER: And if nothing else, it would probably take us another three years to get to that point where we have satisfied the staff of the effectiveness of that backflush capability.

CHAIRMAN BANERJEE: All right, let's move on to your --

MR. BUTLER: All right. The next -- I will skip forward if you will promise me you will look at the slides, at least.

CHAIRMAN BANERJEE: We are looking.

MR. BUTLER: All right.

CHAIRMAN BANERJEE: You don't have to skip forward. You can --

MR. BUTLER: I think this is going to be the last slide. I just want to briefly point out that a lot of the focus of the staff's discussion has been on removing insulation, fibrous insulations. That is certainly one of the bad actors. We won't disagree there but there are two bad actors. The chemical effects and fiber. It is the combination of the two that are causing us all the problems. If you didn't have the fiber and you had the chemical effects, you wouldn't have problems. Similarly if you had the chemical effects and not the -- Did I mess it up?

Anyway, if you take away one, you don't have a problem. It is when you have a combination of the two that you have the problem. So another alternative would be to address the chemical effects.

Now, this is a longer term solution but I know that there are results that this Committee has examined back in 2007 from the French testing that indicated that keeping the pH above seven was not necessarily needed but if you didn't have that buffer there to keep it above seven, that the impact on I-diamond tension would be minimal.

You take out the buffer, that significantly reduces the chemical precipitates. It doesn't take them to zero but significantly changes it.

Water management is another area of design that really hasn't been given full consideration. Fort Calhoun is the only plant that has taken it to its limit, where they actually modified their actuation to not start containment spray on a LOCA event. It will start on a steam line break event, where they need it. They can justify not having it for a LOCA event. That significantly changes the water flow, utilization of the RWST water. It all goes to the core instead of being sprayed into the containment. It reduces the flow through the strainer, which reduces head loss, increases the NPSH margin.

DR. WALLIS: But your strainer still has to work. I mean if your strainer is completely clogged, you can't keep putting water in from somewhere else. You just fill up the whole building.

MR. BUTLER: If you have lower flows, you will not get the same head loss for the same amount of debris.

DR. WALLIS: So you put off the need for the strainer to work to the point where the decay is so low that you don't need that much flow. Is that what you are saying? But if your strainer is blocked --

MR. BUTLER: No. What I am saying is that in some cases for lower flows, you don't block.

DR. WALLIS: You have to do the test then and show that.

MR. BUTLER: Sure. Yes.

DR. WALLIS: But you can't if the strainer is really completely blocked, there is no water management tool.

MR. BUTLER: No, I agree. You are right.

DR. WALLIS: Thank you. It is going to save you for a while.

MR. BUTLER: Yes.

CHAIRMAN BANERJEE: So you have strainer backflush capability. I suppose that was discussed, right, with the staff under 50.46a.

MR. BUTLER: Right.

CHAIRMAN BANERJEE: I mean, option four is not explicitly an option in the sense that it would be factored into the other options. All options would allow you to do things with the buffer, change out the buffer. People have done that.

MR. BUTLER: Well, the difference with Option 4 that I am really pointing to is that they are not -- We know the immediate impact of reducing fiber, changing out insulation. You know, if you reduce the fiber you would now --

With removing the buffer, we are not at the point now that -- Yes, we don't know the impact from a chemical effects would be but we don't have sufficient data to support its impact on radiological retention. You know, the French testing was indicative of a positive impact but it is not sufficient by itself. So that is still being looked at.

So it is going to take time to fully support that type of change.

DR. WALLIS: Well how about strainer management? I don't understand why you put all the debris through the strainer? I mean, if you put, you have five strainers and you run one strainer until it is full clogged and then you run another strainer, you clog those up and catch all the debris. Then you have some clean strainers, which you can use. I don't know why you don't manage the strainers.

CHAIRMAN BANERJEE: Well in a sense Indian Point was considering something like that, wasn't it, where they had --

DR. WALLIS: Don't you gain a lot by straining --

CHAIRMAN BANERJEE: -- sacrificial strainers. Well it was just that it was set up that way, if I remember. They had sort of a sacrificial strainer. And then when that got plugged, they switched it to the other one.

MR. BUTLER: Some plants, each plant is different in how they are designed. Some plants have, there are two trains of ECCS that have separate strainers. So, they are the only plants that could, without a significant design change, implement that type of rationale. But that requires them to not start both trains of ECCS --

DR. WALLIS: At the same time.

MR. BUTLER: At the same time. Which everybody is going to implement that design change.

DR. WALLIS: Well I just don't understand why you want to put all the debris through the smaller strainer and plug it all up.

CHAIRMAN BANERJEE: Well, if it is naturally separated, that is one thing. But I think the point you are making might --

DR. WALLIS: It doesn't run until there is flow through it.

CHAIRMAN BANERJEE: Yes, might need to be looked at because it is not necessary that with these large strainers that you expose all the area at the same time. You could expose some part of it.

MR. BOWMAN: But I have three strainers because I have three trains of safety injection.

CHAIRMAN BANERJEE: Right.

MR. BOWMAN: So we have it written in our procedures how we would manage this but I can't -- obviously, I am the only one in that situation in the United States.

I appreciate the time to speak to this committee.

CHAIRMAN BANERJEE: May we ask John a couple of questions before we move on?

John, we have these estimates of 200 to 600 rem, which was in your letter or in the NEI letter. And we have heard from the staff that their estimates, based on a few things that they could find are quite a bit lower. I think Mike might want to follow this up. You started this line of discussion.

MEMBER RYAN: I mean, we had kind of a staff estimate and then there is three estimates that are off by a factor of 20.

CHAIRMAN BANERJEE: Right.

MEMBER RYAN: That is quite a wide margin between estimates in the same activity in terms of dose.

MR. BUTLER: Well, it might point out to some of the differences. The larger industry estimate was based upon estimates of the dose from a full change out of insulation. It took into account the dose from actually going in and doing the measurements in one outage and the dose replacement at another outage. So that is the maximum.

You know, there is a couple of factors

that play to the maximum. It is looking at a full scope removal. That is number one. Secondly, estimates of dose would tend to be on the high side because actually when you go in there and to the work, our plants are very conscious of dose. So any opportunity they have to reduce that exposure, they are going to do that.

So the actual experience is the actual exposure somewhat lower than original estimates --

MEMBER RYAN: Twenty times lower.

MR. BUTLER: Yes.

MEMBER RYAN: That is not somewhat. That is an order of magnitude times two.

MR. BUTLER: The other factor, which is the main factor here is the plants have actually replaced insulation. They aren't necessarily full scope replacements. They have the capability to go in there and select which insulation am I going to replace. I will stay away from that region and heat exchange --

MEMBER RYAN: No, I am not arguing with the estimating technique of highballing a number. That is fine. But the actual practice has been for whatever has been done, since it is much lower than the estimate. So that is important to get kind of close to reality because that is part of the risk equation you are assessing.

MR. BUTLER: Right. But the point I am still making is that the actual experience is are plants that have not, they have selectively identified which insulation they are going to replace. And you picked the insulation that you can replace at the lowest worker dose. You stay away from that region and heat exchanger that has an extremely high dose. You say I will leave that there.

MEMBER RYAN: That is a small part of the insulation in terms of the total and you optimize your work plan based on taking out the low dose insulation.

MR. BOWMAN: I will just tell you. I mean, we did a level one estimate based on the doses that we have from our outages. We went through and asked the vendor who would do it, how many hours it would take. We took the dose rates in those areas and we did a level one estimate, which obviously always starts and we always work our way down based on dose. So we provided the data because that was our level one estimate, based on good dose rates and hours that were provided to us.

Now, do we always work that down some? Yes.

MEMBER RYAN: And of course, the answer is that is the upper estimate and you are going to work it down. There is just no way around it.

MR. BOWMAN: Well sure, because I want to be a lawyer and I am going to work it down.

MEMBER RYAN: And I am not arguing with that process. I understand it completely. What I am trying to understand is what is the real number so that can be factored into the risk equation. You know, because that is a risk detriment that you have to give up. And it is not 400. It is 20.

MR. BOWMAN: So I will give you for South Texas. We started off about the low end was 100 rem and the high end was 200. We have now got a better estimate. It is 81.

MEMBER RYAN: Okay.

MR. BOWMAN: Now that is per unit for a wholesale --

MEMBER RYAN: Complete removal.

MR. BOWMAN: -- complete removal and complete change out to RMI.

MEMBER RYAN: A lot different than the upper end that was on the --

MR. BOWMAN: Well, as I said, we will try to explain how we got there.

MEMBER RYAN: No, no. I again --

MR. BOWMAN: And I am sure --

MEMBER RYAN: Now that you have explained it, I understand what kind of estimate it was. But it is just sort of a stark thing to see a range of estimates and then a range of reality that is off by a factor of 20.

MR. BOWMAN: To give you another perspective, we just did a full head replacement.

MEMBER RYAN: Yes.

MR. BOWMAN: And the dose for that head replacement was less than 81 rem.

MEMBER RYAN: Right.

MR. BOWMAN: So you know, we are talking about another head replacement or better for each unit to change that insulation.

MEMBER RYAN: That beats clogging the sump.

MR. BOWMAN: Well if you get a chance, I will talk about the risk because I think the risk from a head was considerably more than the risk of a sump clogging.

CHAIRMAN BANERJEE: Let's see. One of the main things which sort of got into this process, if we look at it from our point of view, you brought this thing to some sort of a reasonable level and the staff, we came to an agreement, and they started to get a lot of these plants through the process.

And now, it is 46 or 36 plants or some large number have gone through and have closed down. You have got a few high fiber plants left. Okay?

They were in the process of getting letters out and stuff. To a great degree, what has interrupted this process is the estimates that were put in of these very high doses that would be needed.

Now if the dose is ten times lower than those estimates, it will be this removal of insulation. That puts a completely different complexion on this. If it was truly 600 person rem you might say well, that is a pretty high number. If it is 80 person rem, that is a different number.

So I think, you know, the whole process has been interrupted to some extent, simply due to these dose estimates. And this is why Mike is trying to figure out what sort of a basis there is behind these estimates.

MR. BOWMAN: And I will say as being, if you want to call this one of the high fiber plants and I will give a perspective is we brought this issue up when we started running the numbers on our dose and said, hey, does this match the safety significance of what we are going to fix, what we are going to continue to fix, based on the dose we are going to expend to real workers in our plants. That is why we brought up the issue.

MEMBER RYAN: One thing that might be helpful for us to understand in more detail and I am not sure if it is a question for Tim and John of the NRC staff is what is the actual dose experience for the plants that done it.

CHAIRMAN BANERJEE: They have some numbers.

MEMBER RYAN: But I mean, how does that all sum up? I mean, let's look at the plants by type and you know, high fiber, lower fiber, whatever it might be, and see really how this plays out.

CHAIRMAN BANERJEE: In one of the enclosures that you got from the staff, they summarized the experience of several plants.

MEMBER RYAN: Several but not all that have done it. It is 36, you said or --

CHAIRMAN BANERJEE: Yes, I don't know if they have that available. Maybe Mike or somebody from the staff would answer this question because you are much more knowledgeable than I am.

MR. SCOTT: This is Mike Scott. Is this thing on?

MEMBER RYAN: No.

MR. SCOTT: Okay, I will talk loud. Oh, okay. This is Mike Scott, NRC staff.

We took a sample of approximately eight plants that had, that we knew or found out, had made insulation replacements inside the container and that is what is captured in the enclosure to the SECY paper that Sanjoy was referring to.

I don't know how much larger the entire population of plants that have made that kind of change would be. We have limitations on going out and asking wide-ranging data calls but I am not sure you are going to get to another 20 more plants that have actually done this kind of thing.

MEMBER RYAN: And again, the question really is, you have got a sample of eight. Okay, so be it. And if that data is not readily trackable, then is that a representative set? I am just trying to figure out where the average condition or the range of conditions are for this kind of activity across the system.

MR. SCOTT: Well the way I would look at it is, you have a sample of eight or so plants that made, let's just refer to them as partial insulation replacements. And you have heard from the licensees in here today --

MEMBER RYAN: And Mike, I understand all that. I am just trying to get a handle on it. I mean, I appreciate the fact some people are doing more than others. The plants are doing more, getting more dose than plants doing less. I understand that. But what we need to understand is what does that range of that table look like for the activity --

CHAIRMAN BANERJEE: What do we need to get to you to come to a judgment on this one?

MEMBER RYAN: Dose per plant for a level of effort. Something of that sort.

CHAIRMAN BANERJEE: I think what we need to do -- We don't have much time.

MEMBER RYAN: Let me write something down and give it to you for discussion.

MR. BOWMAN: I think one of the things, what we owe the NRC and I think we are going to talk to the Commission later this month is, for those plants that are remaining, what is the dose estimate for us because that is really the safety significance at this point. Is what do we see as the dose estimates for what we are going to do to get in compliance.

MEMBER RYAN: And that is what the industry -- We as the industry as a whole.

MR. BOWMAN: Correct.

MEMBER RYAN: And I think it would be helpful for us to understand that estimate as best we can, given that that is down the line a bit for the Commission.

MR. BOWMAN: And we fully understand that --

CHAIRMAN BANERJEE: The Commission briefing is not very far down the line. It is the 29th.

MEMBER RYAN: Well a little bit. A month or so.

CHAIRMAN BANERJEE: So it is on the 29th.

MEMBER RYAN: Oh, I thought it was October 29th. I thought it was September 29th.

CHAIRMAN BANERJEE: So I think if the information which forms the basis of these estimates could be maybe discussed at some point with Dr. Ryan so that he feels comfortable that he understands, this is his area of expertise, not mine or --

MEMBER RYAN: One counter-example that will make the point is steam generators pretty much have been disposed and that is a whole unit. The one attempt I know of trying to cut one up turned out to be not a good idea from a dose point of view. There is a counter-example.

You know, dose does sometimes drive the bus of what techniques and to what extent you carry out an activity. I am just trying to get an insight from the experience to date why you are on the path you are on relative to the planning for the follow up activities at other plants.

CHAIRMAN BANERJEE: Well, Salem changed out its steam generators.

MEMBER RYAN: I know all about steam generators.

CHAIRMAN BANERJEE: Yes, so you have got all those numbers. Correct?

MEMBER RYAN: Yes.

MEMBER ABDEL-KHALIK: Now you indicated that STP has revised the dose estimate downward to --

MR. BOWMAN: We are continuing to look at it because it would be a long-range plan of what do we need to do. We continue to refine it. I am not sure that it is going to go down much lower than where we are at.

MEMBER ABDEL-KHALIK: Let me finish my --

MR. BOWMAN: Okay, I'm sorry. I apologize.

MEMBER ABDEL-KHALIK: You indicated that STP has revised the dose estimate down to 81 rem. Have other utilities who were involved in providing this range of 200 to 600 similarly revised their dose estimates and what would the current range be?

MR. BUTLER: I have to go back and look at it. As I mentioned, we are in the process of gathering the dose estimates from the remaining 25 or so plants. If they were to have to make a major insulation change, what would their dose estimate be? And some of those estimates are the same plants that provided earlier estimates for this wide range and I just haven't gone back to look at it.

But there is one particular plant that has a very high estimate. It is based upon the dose in the area that have replaced the insulation and the estimates of the hours from the vendors on what it would take. And it is what it is.

MEMBER RYAN: And again, I accept that but there are ways to highlight. We have one outlier that is the 600 number and the rest of them are -- that kind of thing.

MR. BUTLER: Yes, that is kind of the

outlier.

MEMBER RYAN: I think anything you can do to explain that it is not a normally distributed sample and there are outliers probably on the low end, the high end for very good reasons. The low end is not doing too much insulation removal. The high end may have a different view of the time and motion and manpower that it would take to get it done and what the dose environment is.

So again, I think we are just trying to understand on the average what is the mean or the mode or whatever statistic you want to use to understand what it looks like. But it is difficult to get a feeling for it when it is 200 to 600 compared to 40.

CHAIRMAN BANERJEE: Yes, I think this is the key issue. The key issue as to what we go forward with or what the ACRS will recommend is really the veracity of these dose estimates. So we need to get to the bottom of this.

MEMBER RYAN: I agree.

CHAIRMAN BANERJEE: To the extent you need, Mike, you have a hunting license.

MR. BUTLER: I will be happy to facilitate --

MEMBER RYAN: That would be great, John.

MR. BUTLER: -- discussions between you and the actual plants if you want to explore with them.

MEMBER RYAN: No. I mean, if we can follow up on the conversation we have had on how do we get a better handle on the range of numbers and the averages versus the median or the mode instead of some outlier sort of driving the interpretation of the fewer those numbers the better.

MEMBER ABDEL-KHALIK: What STP's starting point within that range?

MR. BOWMAN: We were 100 to 200 rem.

MEMBER RYAN: You know, and having done an awful lot of dose estimating over my career, I have never come out with an actual number that is in-between my low and high. They are always, you know, they tend to be upper-end estimates. And that is not a bad thing. From a radiation protection standpoint, you really want to understand that upper limit.

MR. BOWMAN: Yes.

MEMBER RYAN: You want to make sure that you are not in an environment you are not prepared to deal with. So there is a normal tendency to overestimate and I appreciate that. But the decision is this a good activity is not made on that health physics thinking, it is made on the actual results. And I am trying to understand how to separate the health physics planning thinking from the actual results of what we get.

So one set of data is what are the actual plant experiences like ER81 and all the other plants, what were their actual experiences for whatever it is they had to do? Now, if this data on oh this was a huge amount of fiber that had to be taken out, this was a small job, that is all helpful information from Sanjoy's perspective but I think you have got to kind of separate the health physics planning mindset, which is I have got to always be prepared for an environment that could be higher than I might first anticipate and come out with a lower number. That is always a good thing from a health physics standpoint and make sure we are talking apples and apples when we present that to the Commission.

MR. BOWMAN: We agree.

CHAIRMAN BANERJEE: Anyway, so because the other thing that also came up in the discussion was that there could be, if there were small pieces of equipment like heat exchangers, that it could be banding or something done, which would give rise to a much lower dose.

That could be something that could be considered as well, you know. You know, you don't have to remove everything but there could be some very high dose areas where some alternatives could be taken.

MR. BUTLER: And plants are looking at that as an option.

CHAIRMAN BANERJEE: Right.

MR. BUTLER: One plant, one of the 25 plants that is still open, you know, when I went out looking to get these estimates and I got back an estimate that was pretty low, a pretty low estimate and I kind of pursued that. Why is this low compared to what I am seeing for other plants with insulation replacements? Because we are not replacing insulation. We are just going to go in an band. For them, that is enough. That is enough to give them what they need to close this issue out. You know, that is what they would consider. They could consider banding to the degree necessary to close the issue out.

CHAIRMAN BANERJEE: Everybody wants to close this issue out.

MR. BUTLER: Yes.

CHAIRMAN BANERJEE: Okay. All right. So

let's let Tim go through it. Go ahead.

MR. BOWMAN: Once again, let me thank you for your time. And as I say, we desire to close this issue out. From 2004 to 2007, we installed much, much larger strainers. We have three trains. We fully expected that at the time we installed them that the strainer testing would pass and we would be closed. That has not come to fruition. In 2008 our testing was based on a reduced WCAP zone of influence, which was called into question. So now we are back into a discussion of strainer testing.

When we started looking at a 50.54f letter that would drive us within a couple of cycles and we started looking at the dose and the cost to really passing a strainer test, I mean, really providing some certainty without sessions about a lot of issues, we came up with the 100 to 200 rem per unit and 30 million dollars. And frankly, we had asked ourselves when we invest in the plant, we ask ourselves, what is the safety implication. What is the safety benefit to our station?

We fully believe that we, based on our determinations that even without the strainer testing, that we would pass to a transition break size, either under GDC-4 determination or under 50.46a. And if that was the situation, we asked ourselves well if the strainers are good enough for that, what are we gaining to go beyond that that we pulled all the insulation off from a true core damage frequency. And we were in a public meeting and my PRA expert, we actually would have an increase of 3E-08 of core damage frequency to actually removing all the insulation and replacing it.

So we asked ourselves, what are we really gaining from this very, very minimal improvement to safety. And that is where we sat down and we were asking ourselves, what are the options. What are the strategies? How do we get to this closure because we desire closure. And so you go ahead on the next slide.

What I want to do is discuss, thinking of a senior manager that is working with engineering to try to future a course. You know, we are looking at all these options. Which one do we think provides us the best certainty, the best regulatory option, the best dose, the best cost. And so just to give you a little idea thinking, we have talked a lot about GDC-4 so you can -- But what I want to do is talk about how we think about the difference between what is Option 3 GDC-4 and 50.46a.

So go ahead and move on. We beat that window like a -- And so if you just do a direct comparison --

MEMBER ABDEL-KHALIK: I would like for you to go back to slide three.

MR. BOWMAN: Okay.

MEMBER ABDEL-KHALIK: Three. Okay. Do you believe the second bullet is a complete statement --

MR. BOWMAN: Yes.

MEMBER ABDEL-KHALIK: -- of how you approach this?

MR. BOWMAN: Yes.

MEMBER ABDEL-KHALIK: The goal is to just demonstrate compliance by reducing cost and worker impact?

MR. BOWMAN: I believe that the safety benefit of continuing to remove insulation is minimal.

MEMBER ABDEL-KHALIK: And the argument regarding defense-in-depth?

MR. BOWMAN: I believe that we have sufficient procedures, training with our operators. We have procedures called loss of emergency recirc. We have training that we do. We don't take credit for those, other than our response to generic letter

2004/2 but we believe that there is sufficient defense-in-depth. And this provides us an expedient way to bring closure.

That is our belief. Now whether it is right or wrong, that is our belief. That is our understanding of the rules.

MEMBER ABDEL-KHALIK: All right.

CHAIRMAN BANERJEE: Do you have procedures in place so that even if your sump screens clogged, you can assure long-term cooling?

MR. BOWMAN: That I would have to go talk to my design guys about and verify because loss of emergency recirc in the emergency operating procedures was considered a contingency, so to speak, a defense-in-depth backup. So I would have to go back and ask that question.

CHAIRMAN BANERJEE: So let's ask it more specifically. Would you be able to demonstrate there is a proposal that eventually 50.46a would come into force. Right? This is Option 2 or whatever. If you were allowed to use non-safety equipment, would you be able to show that you are compliant?

MR. BOWMAN: I do not know. Like I say, I would have to go back and we would have to sit down and look at the designs of the systems, what we could do within the procedures we have and actually sit down and put a pencil to paper from an engineering standpoint.

CHAIRMAN BANERJEE: Okay, let's go on then.

MR. BOWMAN: So, like I said, just from our perspective, GDC-4, we talked about there is some application guidance that may need to be refined for 50.46a. There is no implementation guidance out as of yet and we require additional guidance, which provides some uncertainty as to how you get a path to closure.

GDC-4 and RP, we could be implemented with Commission decision, rather than rule-making as with 50.46a is a rule-making required that would be needed, as was discussed earlier.

GDC-4, to apply for South Texas and the plants that I have talked to require no additional generic testing. Now, we would continue to do zone of influence testing to gain margin back but as we were going to discuss in GDC-4, we would use NRC accepted zone of influences and all that on the largest leak-before-break or maximum leak-before-break line. And I will talk about that in a minute as how we get there.

There is potential in 50.46a because of the uncertainty that there may be generic testing to continue, which is also uncertainty. We believe GDC-4 also provides us a shorter time frame for closure because there is more certainty with the guidance and more certainty of how we would apply and compare to. 10 C.F.R. 50.46a is a longer time period, as we have discussed, due to rulemaking and implementation guidance. So I think I heard probably April, March/April 2012 to have implementation guidance.

DR. WALLIS: So you to apply the GDC-4, you still calculate this large break LOCA for your pre-clad temperature and all that kind of stuff?

MR. BOWMAN: Yes, sir.

DR. WALLIS: And so there is something very inconsistent in applying a large break LOCA for some of the results and some of the effects and not for some of the other effects.

MR. BOWMAN: Yes, we have had this discussion on the inconsistency.

DR. WALLIS: Well, I think you should be consistent. I think if, you know, it is kind of, I am tempted to use words which are inappropriate to say that we are only going to consider -- You know, we are going to consider there is a large break LOCA for some of the consequences and not for some of the other consequences. And that is very strange.

I don't really want to pursue my argument because I might get into hot water. I mean, you could apply to all kinds of moral issues. You know, you only need to consider some of the consequences of what you do and not the other ones. It is a strange way to proceed.

MR. BUTLER: It is just we are in that strange way right now. We have been there ever since '84 when the rule was implemented.

DR. WALLIS: Well, I know but only because there was a benefit and not to removing these things which were obstructing the pipe.

MR. BUTLER: That benefit came from allowing the removal of the pipe whip restraints and jet impingement shields. They didn't require that that same benefit be demonstrated for every application of the rule. Otherwise, well it hasn't been done to date.

MEMBER ABDEL-KHALIK: Let's proceed.

MR. BOWMAN: Okay. GDC-4, in our opinion, provides more certainty and is a more straightforward resolution because 50.46a final wording has not been met and implementation guidance is not a certainty. So this about what we believe is more certainty versus uncertainty.

There are some other benefits. There was precedent. Go back and look at Unresolved Safety Issue A-2 under NUREG-6765, where it was used on asymmetric loading. It was not necessarily part of the quandary that we are at, discussion that we have had already.

It does reduce the possibility of large dose impact modifications. I am not saying we would not have to remove and replace some insulation. We may have to in order to get there, but it reduces the possibility of large scale insulation removal.

And it would be a better and more appropriate use of the industry's and the NRC's resources on the remaining safety significance of this issue, which as I said from our standpoint is on 3E-08 range.

So I am going to talk just a little bit about sensitivity. If you look at South Texas our core damage frequency for a large LOCA is 9E-04 -- 9.4E-09, excuse me. This is based on a NUREG for initiating event frequency. And we ran some sensitivity studies on total sump plugging events and how it affects our core damage frequency.

And so you can see in the next slide, if you start off with a probability of E-05, then it has very little affect on core damage frequency. As the probability goes up to the E-02 range, the core damage frequency goes up to 3.3E-08.

So from a risk perspective, total sump clogging has, of course we are talking about core damage frequency -- Also a owners' group sensitivity study came up with similar results. So this is what we were looking at from a risk impact standpoint.

So how would we apply? What would we do? We would have to demonstrate that the strainer qualification addresses the limiting debris generation, using methods accepted by the NRC. We would identify through a license amendment, we would identify the qualified leak-before-break piping. We would determine the limiting debris generation for the non-leak-before-break and then have a discussion of defense-in-depth measures and actions to maintain defense-in-depth. That would be part of our submittal. Next slide.

In order to determine the debris generation, we would use the safety evaluation on NEI 04-07 guidance. That would determine the maximum amount of debris that is transported to the sump screens, based on non-leak-before-break piping and the worst combination of mixes that are transported to the sump screens.

And at South Texas, the largest break line would be a 12-inch residual heat removal suction line and that would be our basis for our largest non-leak-before-break line. Of course, you would have to do a sensitivity in comparison to the smaller non-leak-before-break lines but we believe that this would probably be the line that would probably generate the maximum debris. Next slide.

And then we would use the NRC methodology to determine not only the location but also the amount of debris that was generated. We would use zone of influences that were acceptable to the Nuclear Regulatory Commission right now. And so at South Texas, we did a determination. It is not a final calculation but we did a determination that if we used GDC-4, we used the methodology and safety evaluation of NEI 04-07, used the accepted zone of influence by the NRC, we would generate 125 cubic feet of fines at the sump. So ask yourself, how does that compare to your sump testing that you have already done?

In July 2008, we were successful with 77 cubic feet of fiberglass fines based on a reduced zone of influence. So you say well wait a second. Your 125 is more than that. However, we have removed some

CalSil from the station, which would change our chemical effects and we believe and our determination has been that the reduced chemical loading would be offset, would offset the increased fibers.

Now, we would have to test that. We would have to set up a protocol and test that. We are already talking about testing and we are setting up a test protocol. So part of this determination of GDC-4 50.46a is what do we do. What do we set up for our protocol for our strainer testing?

CHAIRMAN BANERJEE: What sort of strainers do you have?

MR. BUTLER: ECI strainers.

MR. BOWMAN: ECI. That is correct.

MR. BUTLER: They are a stacked disk.

CHAIRMAN BANERJEE: Stacked disk?

MR. BOWMAN: Yes, sir. So let me go to the next slide.

CHAIRMAN BANERJEE: They are in sort of a whole larger hole or whatever.

MR. BOWMAN: Yes, sir. We have a large rectangular hole and they are stacked on top of that.

CHAIRMAN BANERJEE: On top of that. And what is the area?

MR. BOWMAN: Six or seven feet by fifteen or sixteen feet each.

CHAIRMAN BANERJEE: You mean that --

MR. BOWMAN: You mean the surface are of the strainers or what?

CHAIRMAN BANERJEE: No the hole on which it is.

MR. BOWMAN: I don't have that.

CHAIRMAN BANERJEE: What is the footprint of the strainers?

MR. BOWMAN: I just want to say that is probably seven feet by sixteen and stacked up. And I don't know the exact surface area.

CHAIRMAN BANERJEE: One hundred and twenty-five cubic feet. This 125 cubic feet is at what density we are talking about? Is it --

MR. BOWMAN: I don't have that information.

CHAIRMAN BANERJEE: Is this the fluff or when it is solid gas?

MR. BOWMAN: Let's see. Let's see what my guy told me it was. Twenty percent fines, eight percent smalls, ten percent erosion of smalls, ninety-five percent transport fraction.

CHAIRMAN BANERJEE: Yes, but I mean when you arrive at this 125 feet, what is the density that you are using? I mean, how many pounds of stuff is there in that hole?

MR. BOWMAN: I don't know.

CHAIRMAN BANERJEE: Okay.

MR. BUTLER: Generally, and I think I am correct in saying this, when they speak of cubic feet, they are speaking of the volume as installed integration. But when you are talking about fines, I don't know if it still applies.

DR. WALLIS: Well I think 77 cubic feet of fiberglass could probably absorb a lot of stuff inside it, couldn't it?

CHAIRMAN BANERJEE: I don't know but is 77 cubic feet of fiberglass ten pounds of fiberglass or 100 pounds?

DR. WALLIS: I could absorb the rest of the debris inside its voids.

CHAIRMAN BANERJEE: It would be nice to have a number as to how many pounds we are talking about. So 125 cubic feet.

DR. WALLIS: Which is much less than you would have with the large break LOCA.

MR. LEHNING: This is John Lehning from the NRC staff. Typically what we see is 2.4 pounds per cubic foot.

MR. BUTLER: Okay, thank you.

MR. BOWMAN: We are on the next slide. Let me talk about --

CHAIRMAN BANERJEE: Excuse me. That is 2.4 pounds per cubic foot? That is for fiberglass. Well, that is for this sort of stuff. But for the other stuff, it is much denser. The particulate it is 30 or something or 50 or depending on what it is.

MR. BOWMAN: Part of the GDC-4 submittal is margin management. And this applies not only for South Texas but some people that would even have the issue was closed is they may be able to improve their margin by doing selective replacement or banding or additional strainers. That is what South Texas we are looking at what is the combination that is the dose, what gives us the cost, what gives us the closure. So we are looking at the myriad of options of how we can get the mix correct.

By doing this, we could significantly reduce our dose and cost scope if we did not have to do a full-scale insulation replacement.

MEMBER RYAN: Do you guys know if other plants have done that same kind of process, trying to optimize? Yes and again, that is the kind of information that I think would be very helpful to understand. Get some insights from that.

MR. BUTLER: But I have got to make the point. What option, what combination of options makes sense because upon what you are baseline criteria, what your course is, whether you are going on option --

MEMBER RYAN: Well it could have an impact of informing the committee of how balanced the various parts of the risk equation to get a small accomplishment in reduction of damage frequency causes a large dose, you might think about which of the options should you pick, based on those optimizations. But if the dose is not so high and there is a bigger benefit somewhere else, you might say well, let's go ahead and do that.

So it is part of the equation that we have to consider. So anything you can do to help us understand that profile, here are the options and here is at least the dose part of it, that is one important aspect of balancing the risks, I think.

MR. BUTLER: Yes, and that is exactly what you are doing here.

MR. BOWMAN: Yes, exactly.

CHAIRMAN BANERJEE: The problem of course which you won't know the answer to or maybe you do know the answer and we don't, will be what all this means in terms of downstream affects. Eventually, you know, you might have to remove insulation for downstream --

MR. BOWMAN: That is the lynchpin is the determination of the testing that is going to be going on this Friday in the final safety evaluation report is going to dictate a lot of what people do because, you know --

CHAIRMAN BANERJEE: All this may be irrelevant.

MR. BOWMAN: It's all relative. It is just how relative is it. For us, it doesn't look like it is going to be an issue but we have got to wait until the final testing is complete.

Let me do a quick conclusion. We think we Option 3 GDC-4 provides a good methodology for closure. It is timely. There is no rulemaking or guidance available. It addresses incremental risks, minimizes dose and provides a mean to regain margin.

So, I understand we have had the dialogue in the other but we think this has some of these positive attributes to us that we look at.

Now, I want to reiterate what John said. We are in agreement with the staff that a 1b in combination with a longer term to deal with the more likely small break LOCAs first, we agree with. The large break LOCAs, like I say, we are in this discussion today to make sure that we have the right or what we think is the right combination or the right factors options of how we get to that closure. But we agree with that fundamentally with the staff that we want to get those small break LOCAs, we want to get that addressed.

CHAIRMAN BANERJEE: And for that, you wouldn't have to remove any insulation?

MR. BOWMAN: Well we might have to.

CHAIRMAN BANERJEE: You have to take a number of measures.

MR. BOWMAN: We will have to take some appropriate set of measures but it is kind of interesting intermixed --

CHAIRMAN BANERJEE: Are the large break LOCAs emanating from the sumps? You might be able to figure out a way to have defense-in-depth.

MEMBER SHACK: But then he has got to have means to regain margin so that he can push the system a little harder.

MR. BOWMAN: I'm not so sure I want to push that one.

CHAIRMAN BANERJEE: All right.

MR. BUTLER: One thing is for certain. People aren't going to be -- increases in insulation fibrous insulations in the future. The tendency will be if you can replace it with RMI or some non-problematic fiber you are going to be doing that at every chance you get.

CHAIRMAN BANERJEE: Interesting that you replace some with NUKON.

MR. BUTLER: Yes, we did.

CHAIRMAN BANERJEE: They replaced some insulation with NUKON. Very brave.

MR. BUTLER: That is their main insulation type at STP.

MR. BOWMAN: We were being requested why do we still have CalSil in. So we went to NUKON and got rid of the CalSil for the chemical effects.

CHAIRMAN BANERJEE: Right. You didn't know about NUKON at that time, I presume.

MEMBER SHACK: For chemical affects or for particular affect? I mean, you could have changed the buffer.

MR. BOWMAN: We haven't gone to touch our buffer yet.

MR. DINSMORE: Mr. Chairman?

CHAIRMAN BANERJEE: Anyway -- Yes?

MR. DINSMORE: If you are so inclined, the staff has prepared just a few short remarks in response to some of the questions that were raised or not. It is up to you.

CHAIRMAN BANERJEE: No, we would like to definitely --

MR. DINSMORE: Okay.

CHAIRMAN BANERJEE: -- hear. We are willing to --

MR. DINSMORE: We are talking about five minutes.

CHAIRMAN BANERJEE: Yes.

MR. DINSMORE: Thank you for your time.

CHAIRMAN BANERJEE: Thank you, John. Thank you, Tim. Very, very interesting. So, Mike, are you going to talk a little?

MR. SCOTT: Thank you, Dr. Banerjee for giving me an opportunity just to respond to a couple of points that were made here. As the industry folks discussed, we are in agreement with them on some aspects of this. And of course, we are in disagreement on other aspects. In the NEI presentation, there was a semi-lengthy discussion about the difference between a global and a local effect --

CHAIRMAN BANERJEE: Slide number?

MR. SCOTT: Let's see. It is starts on slide, eight, I think. Yes.

The staff does not agree about the discussion about he intent of the Commission with regard to the revised GDC-4 rule. That is to say, we see the debris generation issue as global because the debris that is generated travels to the sump and causes potentially a loss of the ECCS which is referred to in slide number nine in the NEI presentation, the second sub-bullet.

In any event, you know, you look back at the statement of consideration and you reach conclusions, just like the industry reached conclusions on what the Commission intended. We are not at the same places they were for the reasons that I have stated and they have stated. But as the staff emphasized, even leaving all that aside, because the commission is, of course, entitled to look at this in a brand new light as they care to.

We have slide after slide of reasons why we don't think that this is the appropriate thing to do. So we don't agree about what the original intent was but our argument contains much more information than that. So that is just one point.

Regarding the missing Option 4 that John Butler referred to, and this was referred to obliquely at least, there is an ongoing process to see where buffer removal, whether buffer removal would be a right thing to do from a global -- I shouldn't say global. We are starting that discussion again. From an overall perspective and there are many potential impacts of buffer removal, some of which involve some performance, some of which don't.

There is a long-term international research effort intended to get to answers for that. I think John Butler referred to it as being several years out and we agree with that. That is not a near-term solution to this problem. There might be some benefit in the future. We don't know what it would be. Buffer removal does not remove chemical effects, as John Butler noted. It causes different chemical effects. We don't know how that will play out.

MEMBER RYAN: Mike, the short answer is this is an area of some interest but it is years out --

MR. SCOTT: That's correct.

MEMBER RYAN: Okay, but you are following it.

MR. SCOTT: Yes.

CHAIRMAN BANERJEE: But you have looked at buffer substitutions with other buffers.

MR. SCOTT: Right. And there is a pretty well established state of knowledge about the impacts of the different buffers. And several licensees have changed buffers but that is different from removing the buffer and having none at all. And I think this bullet was intended to refer to that. And it is certainly, as was said, it is of interest but it is out there.

And that is mostly why it was not discussed in our paper.

DR. KRESS: Are all the control rods in the PWRs silver-indium-cadmium?

MR. SCOTT: Say again?

DR. KRESS: Are all the control rods.

MR. SCOTT: I believe that is correct, yes.

DR. KRESS: All silver-indium-cadmium? I thought some of them were different but I don't know. But to remove the buffer, you have to have the silver because that is what keeps the iodine from getting back out of the sill.

MR. SCOTT: You have exceeded my knowledge level on that subject already.

DR. KRESS: It is the silver that does it for you.

MR. SCOTT: It keeps the --

DR. KRESS: Yes.

MR. SCOTT: Okay.

DR. KRESS: It ties up the iodine so it doesn't leak.

MR. RULAND: If I could recall. When the research issued the sill, on the Favus Research the conclusion of Favus was that the species of iodine had no affect on -- the buffer had no affect on the species of iodine that was released post-LOCA. And that was the reason research was telling us, well you can just remove the buffer.

Now it is the NRC's staff's view that that was just the first step in trying to decide where we head with this. So we, like you said, we are a long way away from deciding, taking research findings and actually implementing it into the regulatory regime.

MR. SCOTT: Moving to the other items here, Dr. Banerjee correctly stated that the water management and even the backflush are on the table now. They are not addressed or at least management is not addressed specifically in the SECY paper but a licensee can use and the staff has encouraged licensees to consider using approaches such as this. The one plant that has used water management is still in discussions with the staff about its testing. So I don't think necessarily that this is a slam dunk to get you completely done with the issue.

But we certainly recognize that it could help and could be applied in conjunction with Options 1 or 2 or 3 as was previously mentioned.

MEMBER SHACK: Well, one is your holistic one. Right? I thought your whole list concluded things like water management.

MR. SCOTT: It concludes whatever the licensee wants to come to the staff with. See, this is the important thing. As Bill Ruland said, we don't go say okay, everybody, let's do water management.

We say, we are amenable to being approached about an analysis that supports water management. And if a licensee wants to come forward now and propose buffer removal, we will look at it. We think there is a lot of wholes in the knowledge base for that but we will look at it.

MEMBER SHACK: The nice thing about buffers is they control the chemistry, among other things.

MR. SCOTT: Although the Germans don't have them. And they have different issues. They have corrosion issues with their materials. So it is different.

MEMBER ABDEL-KHALIK: This is not an all-inclusive list of design modifications. Any applicant who comes to you with a design modification that potentially can address this issue, you will consider it.

MR. SCOTT: Correct. And we have not told anyone go forth and remove your insulation. We have said, go forth and show that your strainer will function correctly.

CHAIRMAN BANERJEE: Well my point was that Option 4 was already contained within the other options. It did not specifically have to be shown as one.

MR. SCOTT: I believe you. I agree with you.

CHAIRMAN BANERJEE: That was really, you could do all those things.

MR. SCOTT: The one point that I would make on the South Texas presentation, we have agreed that the probability of occurrence for a large LOCA is small. And that is why we are amenable to a longer term demonstration of compliance with regard to those large breaks. So the difference of opinion there is simply whether we put all our eggs in that will not occur basket or not.

Now I did hear there was discussion about compensatory measures and how that might work out but we have nothing on that at this point. Our view is that we need to have the mitigated features that are part of the 50.46a proposal.

So, that is really all I have. Thank you.

CHAIRMAN BANERJEE: Thanks, Mike.

MEMBER SHACK: What does that mean, they would be three? Commander 1174 with a risk-informed proposition that might include a defense-in-depth argument.

MR. SCOTT: Sure. They can propose whatever they want to propose and the staff will look at it with an open mind.

CHAIRMAN BANERJEE: Good. Thank you very much.

MR. SCOTT: Thank you.

CHAIRMAN BANERJEE: And I would like to thank both the staff and NEI and STP for very interesting presentations, which we much appreciate. Now we have to do some hard work, guys. We have to try and right our views on this.

Okay, so before breaking up, is there anything that we should indicate about the full committee meeting areas to emphasize or areas which might catch the attention of the committee?

MEMBER ABDEL-KHALIK: Will the industry representatives also make a presentation to the full committee?

CHAIRMAN BANERJEE: Well, I have told Ilka that we would certainly give proportionate time.

MS. BERRIOS: We have one and a half hour for the staff and half an hour for NEI.

MR. SCOTT: I'm confident we will use every bit of our one half hour.

CHAIRMAN BANERJEE: I'm sure. So is there any -- The first thing I would like to address is are there specific items that this committee, subcommittee feels needs to be addressed or would be best addressed --

MEMBER ABDEL-KHALIK: I think that the measured tension that comes through is the disagreement on GDC-4 and perhaps that should be emphasized in the presentation, I would say.

CHAIRMAN BANERJEE: The pros and cons.

MEMBER ABDEL-KHALIK: Right.

DR. WALLIS: Don't spend too much time on that because it seems to me logically clear that it doesn't apply.

CHAIRMAN BANERJEE: But that is the Commission --

I think there, though Graham, the way you read this --

DR. WALLIS: It is not designed to --

CHAIRMAN BANERJEE: Yes, but it still is a policy decision which the Commission can make. So I think it is on the table. Don't take it off the table.

MEMBER SHACK: It is clearly on the table.

CHAIRMAN BANERJEE: So I think we do need to say something as a committee about it and we should be informed as a committee about the different points of view.

DR. KRESS: I think the kicker there, Sanjoy, is going to be the defense-in-depth argument. You know, it is hard to quantify unless defense-in-depth are losing. So I think if I were going to emphasize anything, I would emphasize the need for compensatory measures in case you give credit for a leak-before-break. You know, have another way to deal with it.

DR. WALLIS: You could have a 50.46a, then.

DR. KRESS: Not necessarily.

DR. WALLIS: Well something like that.

DR. KRESS: I mean, the Commission could say yes, we will let you use the leak-before-break environment if you also give us a way to have another compensatory measure that gives us the defense-in-depth we need.

DR. WALLIS: If they were there at all.

DR. KRESS: If they go there at all.

DR. WALLIS: Well, I think it would be good if the question of the dose for removing the fiberglass could be clarified, instead of having these large discrepancies. That would really help the committee.

MEMBER RYAN: And I was going to volunteer to just write something up for you Sanjoy as a draft but I couldn't agree. I think the real secret here is let's focus on the plants that have done it and what their actual experience is and have that at least as a channel marker for what it might look like at the other plants. Because that is the currency that really makes sense.

I mean, these estimates tend to be upper estimates anyway.

DR. WALLIS: Diminishing returns. I mean to remove 90 percent of it may, you know, as much as moving the last ten percent.

MEMBER RYAN: Yes, all that needs to come into play. So I would be happy to --

CHAIRMAN BANERJEE: How would we, I think Graham's point is a good one that removing 90 percent might be easy and the last ten might be very hard.

MEMBER RYAN: It could be just the other way around.

DR. WALLIS: Well, let's get the facts.

MEMBER RYAN: Right. I think the key is, let's look at the facts of the actual experience to understand what the dose commitment is and how does that factor into the risk equation?

CHAIRMAN BANERJEE: So can you --

MEMBER RYAN: I guess we can work with both the staff and --

MEMBER SHACK: It is still very difficult to do, Mike. You don't know how much you need to remove at each plant.

MEMBER RYAN: I'm not saying we are going to know that. I am simply saying --

MEMBER SHACK: The only one we have heard for an estimate of how much they thought they might really use --

MEMBER RYAN: I'm asking a very simple question. You estimate between 200 and 400 and the experience is 20 times less than that.

MEMBER SHACK: Yes, but still it is an apple and oranges comparison.

MEMBER RYAN: It is a meaningless comparison when the estimates don't match reality. So I am just trying to understand what is the range of reality. We heard about one or two examples.

CHAIRMAN BANERJEE: I think we should listen to people. So what I think all we can say is that this would be a subject which should be addressed in addition to, of course, GDC-4, this would be of interest to the committee. The more information we could get about this in a succinct way, the better it would be.

MEMBER RYAN: It could be very simply that the experience to date is what would play out. So that gives you one insight as to what the dose commitment is for the activities or it could be higher at certain plants.

CHAIRMAN BANERJEE: Mike and John, I guess, we would, the full committee, in other words, would be interested to have whatever summarized information is available in this area.

MR. SCOTT: And for us, that information is in enclosure which?

CHAIRMAN BANERJEE: Well, I have seen --

MR. SCOTT: Attached to the SECY paper.

CHAIRMAN BANERJEE: Yes.

MR. SCOTT: We really have little more than that.

CHAIRMAN BANERJEE: Okay.

MR. SCOTT: But it does have specific plants and a brief description of what was done for those plants.

CHAIRMAN BANERJEE: Could you put that on a slide or something?

MR. SCOTT: Yes.

CHAIRMAN BANERJEE: All right. That would be useful.

MR. RULAND: The key piece of information here, which is what the delta is between doing what they are doing now and no leak-before-break or leak-before-break, it is the difference in dose that ultimately is the item, I think, that is really the decision point. And what you heard today from South Texas was the total just. So it is not the delta.

The delta something less than that. And to actually come up with that number, at this juncture, I would argue, is an extremely difficult thing to do.

MEMBER RYAN: And Bill, I appreciate that clearly but I think we are just trying to get Russell some handle on it. It is not a factor of 20 either.

You know, we are kind of comparing apples and oranges.

MR. SCOTT: But when you look at what South Texas, what they said there --

What I was going to say is when you look at what their estimate was, which was 80 for a full scope replacement and the references we gave you in the vicinity of 40 for parts replacement, they are not that far off.

CHAIRMAN BANERJEE: Okay. All right, are there any other important points? Would you quickly write me whatever needs to be written?

DR. WALLIS: Before tomorrow?

CHAIRMAN BANERJEE: Before tomorrow.

DR. WALLIS: I doubt it.

CHAIRMAN BANERJEE: No, by tomorrow, you will be wherever.

DR. WALLIS: I will send it.

CHAIRMAN BANERJEE: But I have to write a letter.

DR. WALLIS: You can't write a letter this week.

CHAIRMAN BANERJEE: This week, yes.

DR. KRESS: We will send you a--

CHAIRMAN BANERJEE: I have written a letter but I want to factor your insight.

MEMBER ABDEL-KHALIK: It goes without saying that we all owe it to the commission to provide accurate estimates of these dose numbers because the decision will ultimately be biased one way or the other by biasing these numbers either to the high end or to the low end. And, therefore, it is very important to get as good an estimate of these dose values as you can put a hand on.

CHAIRMAN BANERJEE: All right. So that is done. GDC-4. Is there any other points that we should talk about? Anything that either we should talk about as a subcommittee or that the staff or NEI know?

MEMBER ABDEL-KHALIK: Other than saying the staff has done an incredible job in a very short period of time. I was very impressed.

MR. RULAND: Just two seconds here. I

must acknowledge today is Mike's last day to appear before the subcommittee as the GSI-191 Branch Chief.

CHAIRMAN BANERJEE: Where does he go? Tell us.

MR. RULAND: I realize -- Well, Mike is going to be going to research on October 12th. Right Mike?

So anyway, this is his last meeting and he is sorely disappointed that he is not going to be able to do this again. That is what he told me.

MEMBER RYAN: We should have a research briefing soon after October. Don't you think?

CHAIRMAN BANERJEE: He is going to list the --

MR. SCOTT: I did my first ACRS briefing on sumps the week I took this job. So that would be no problem.

CHAIRMAN BANERJEE: I remember.

All right. Thank you all very much. Now the meeting is adjourned.

(Whereupon, at 6:02 p.m., the foregoing meeting was adjourned.)

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Closure Options for Generic Safety Issue 191, PWR Sump Performance

Presented by:
Christopher Hott/Michael Scott
Office of Nuclear Reactor Regulation

Presented to:
Subcommittee on Thermal-hydraulic Phenomena
Advisory Committee on Reactor Safeguards
September 7, 2010

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Purpose of Presentation

- Provide background/context for SECY paper
- Discuss current status of resolution of sump performance issue
- Discuss views of stakeholders
- Provide overview of the SECY paper
- Discuss staff's recommendations

Background

- Generic Safety Issue (GSI) 191 involves demonstration that emergency core cooling system (ECCS) strainers will perform acceptably after a loss-of-coolant accident (LOCA)
- GL 2004-02 requested licensees perform detailed mechanistic evaluations of ECCS and containment spray system (CSS) functions and make modifications as needed by December 31, 2007
- NRC staff concluded and ACRS supported that near-term action to make PWR strainers larger was prudent
- Licensees increased strainer sizes by 1-2 orders of magnitude

Background (Cont'd)

- Issue has evolved as understanding has improved regarding various aspects of the problem since GL 2004-02 was issued
  - Impact of debris arrival sequence
  - Chemical effects
  - In-vessel downstream effects
  - Thin-bed effect
- Each licensee has made a major effort to resolve the issue, but licensees and staff have been repeatedly challenged by emergent issues

Issue Resolution Status

- 33 of 69 PWRs have already performed analysis and strainer testing using methods acceptable to the NRC staff -13 more plan to do the same
- Most of the 23 remaining plants have relatively large amounts of fibrous insulation
- Attempts to credit test and evaluation refinements have not generally succeeded
  - Debris generation/zone of influence (ZOI) reductions
  - Debris settling credit
- Staff has accepted testing that credits reduced debris erosion
- Industry planning new efforts to credit settling and ZOI reductions – staff will evaluate

Commission Brief April 2010

- Staff planned in early 2010 to push toward final near-term resolution via 10 CFR 50.54(f) letters
- In April 15 Commission brief, industry stakeholders expressed concerns about staff path forward
  - Little safety benefit
  - Large radiation exposure to workers
- Industry-preferred path forward was application of leak-before-break (LBB) to sump evaluations
- Union of Concerned Scientists letters
  - Staff on track to successful issue closeout
  - Could support LBB under specified circumstances

Staff Requirements Memorandum (SRM) May 2010

- Staff should not issue letters under 10 CFR 50.54(f) pending further Commission direction
- Staff should report to Commission by 8/27/2010 on potential approaches to closure, including:
  - Realistic ZOI
  - Application of General Design Criterion (GDC) 4 (LBB)
  - In-vessel effects of different fuels
  - Risk-informed resolution (e.g., proposed 10 CFR 50.46a)
  - Alternative regulatory treatment of in-vessel effects
  - Dose impact of resolution options
  - Consult with the Committee to Review Generic Requirements to ensure closure approaches comply with backfit requirements

Staff Response to SRM

- Considered new information provided by stakeholders to reconsider GDC-4 application to sumps
- Considered present and potential future risk-informed approaches
- Evaluated dose impacts
- Considered other options for issue resolution
- Considered how best to treat in-vessel effects (separate issue?)

Options Discussed in SECY-10-0113

- Option 1: Current holistic integrated approach, with or without firm schedules
- Option 2: Develop additional risk-informed guidance
- Option 3: Allow application of LBB to sump evaluations

Staff-Recommended Options

- Combination of Options 1 and 2
- Near-term resolution schedule for smaller LOCAs, and longer-term schedule for the less-likely larger LOCAs
- Revisit risk tools for GSI-191
  - Existing alternate methodology in 2004 safety evaluation
  - Proposed 10 CFR 50.46a
- Option 3 not recommended for reasons discussed in later presentation

GSI-191 – Safety Issue?

- LOCAs of low probability, particularly large breaks
- Inability of sumps to pass adequate flow could lead to core damage and loss of mitigation system (containment spray)
- Uncertainties in sump performance, particularly for “high-fiber” plants, are significant absent a defensible test
- LOCAs as small as 3 inches can challenge sump performance
- Prudent to not allow uncertainties to continue indefinitely

How much debris reaches the strainers?

- Lack of realistic models in areas critical to sump performance is the source of large uncertainty
- Bounding models are used to determine:
  - How much debris is generated
  - How much debris transports to the strainer
- The staff believes these models are conservative, though not overly so
- Industry believes models are overly conservative, and some licensees have tried to justify refinements in key areas of debris generation and transport
  - Reduced ZOIs
  - Debris settlement credit

Refinements are key to SECY paper options

- Option 1, including setting a schedule for issue resolution, retains bounding models but allows licensees some time for currently proposed new testing to support refinements
- Option 2 would allow some refinements in models for evaluating larger breaks due to their very low likelihood
- Option 3, the industry-preferred option, would provide the largest refinement
  - No debris is assumed to be generated from breaks in LBB-qualified piping
  - All PWRs' large reactor coolant system piping is LBB-qualified

Dose Impacts

- Stakeholders indicated doses of up to 600 Rem and average of 200 Rem to replace all fibrous insulation
- Staff obtained data samples from a limited number of licensees who have replaced some insulation in containment – doses ranged from 5 to 44 Rem with an average of 19 Rem
- Staff data likely not bounding of worst case
- Some “high-fiber” plants might not need to remove all fibrous insulation

In-Vessel Effects

- Industry planning “cross test” for September 2010
- Draft safety evaluation (SE) to be issued by September 2010
- ACRS review October/November 2010
- Final SE early 2011
- Staff view – strainer performance and in-vessel effects closely linked
- Resolving strainer issue in absence of consideration of in-vessel effects could lead to a strainer that would not clog and a core that would

Advantages of Recommended Approach

- Reasonably near-term resolution of an issue the staff sees as significant
- Allows time for additional attempts to refine evaluation methodology
- Maintains sufficient defense-in-depth
- Incorporates available risk insights
- Continues demonstrably successful issue resolution process
- Contains checks and balances to reduce likelihood of staff requiring excess conservatism
- Implementation schedule is risk-informed and takes into account the amount of planning and effort required for licensee implementation

Enclosure to SECY paper more extensively discusses advantages and disadvantages of each option

Follow-on Presentations

- Leak-before-break
- Risk-informed considerations and proposed 10 CFR 50.46a
- Summary

Consideration of General Design Criterion 4 for the Resolution of GSI-191 Issues

Presented by:
Tim Lupold/John Tsao
Office of Nuclear Reactor Regulation

Presented to:
Subcommittee on Thermal-hydraulic Phenomena
Advisory Committee on Reactor Safeguards
September 7, 2010

Commission Direction

- By letters dated April 7 and 27, 2010, the industry proposed to use General Design Criterion (GDC) 4 to resolve GSI-191 issues. If approved, licensees may not need to remove fibrous insulation from piping
- By letters dated April 14 and 26, the Union of Concerned Scientists (UCS) provided comments on the application of GDC-4 to resolve the GSI-191 issues
- On April 15, 2010, the Commission held a public meeting to discuss the GSI-191 status
- In the Staff Requirement Memo dated May 17, 2010, the Commission directed the staff to evaluate application of GDC-4 to bring GSI-191 to closure

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Background

- GDC-4 permits dynamic effects from pipe rupture to be excluded when analyses, reviewed and approved by the Commission, demonstrate an extremely low probability of pipe ruptures
- The analyses referred to in GDC-4 are related to Leak-before-Break (LBB) methodology
- The LBB concept is based on testing and analyses verifying pipe material has sufficient resistance to uncontrollable crack propagation. Pipe will most likely develop a small crack such that an operator would identify leakage and take corrective action before rupture
- Standard Review Plan (SRP) 3.6.3 provides guidance on the LBB analyses

GDC-4 Rule: Statement of Considerations

- LBB credit enhances safety through the removal of plant hardware (i.e., the removal of pipe whip restraints and jet impingement barriers) that negatively affects plant performance, while not affecting emergency core cooling systems (ECCS), containments, and environmental qualification of mechanical and electrical equipment
  - LBB enhances safety through the removal of barriers to inspection
- LBB applies to local, not global, dynamic effects
- LBB removes the requirement to consider jet impingement forces on adjacent components, decompression waves within the intact portion of the piping system, and dynamic pressurization in cavities, subcompartments, and compartments

Advantages

- If GDC-4 is permitted to be applied to GSI-191
  - Might eliminate the need for additional insulation change-outs at some affected plants – thereby reducing worker radiation exposure
  - Would likely reduce the scope and number of needed insulation change-outs at affected plants
  - Might eliminate need for additional strainer testing for some affected plants
  - Licensees who have already shown satisfactory strainer performance could potentially recover operational margins
  - Could simplify assumptions in GSI analysis and staff review for GSI-191

Disadvantages

- Large reduction in defense-in-depth
  - LBB credit could allow large amounts of potentially problematic materials to remain in containment
  - If an LBB pipe ruptures, despite being a low-probability event, it would cause debris generation that would be unevaluated for impact on ECCS strainer performance
  - Small amounts and combinations of debris have been shown in testing to cause sump failure
  - Sump failure following a LOCA in LBB piping would likely cause loss of the ECCS core cooling (a prevention feature) and also result in loss of the containment spray system (a mitigation feature) without any additional protection system failures

Disadvantages (Cont'd)

- Primary water stress corrosion cracking (PWSCC)
  - LBB piping typically contains welds with Alloy 82/182 material which is susceptible to PWSCC
  - Industry has implemented guidance and programs to minimize the impact of PWSCC such as augmented examination
    - Some mitigation measures such as weld overlays and stress improvement have been implemented by some licensees
  - Additional analyses would be needed prior to applying GDC-4 to GSI-191
  - SRP 3.6.3 does not permit an active degradation mechanism (e.g., PWSCC). Increased inspections are an interim response relating to LBB piping

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Disadvantages (Cont'd)

- Even if GDC-4 is approved, dynamic effects from non-LBB piping and loss-of-coolant accident (LOCA) sources such as manways or valve bonnet blow-outs will need to be considered in debris generation
- LOCAs outside scope of LBB would be unaffected by this credit and could be problematic for some plants
  – LBB has not been approved for less than 6-inch pipe
  – Not all plants have requested LBB approval beyond reactor coolant system loop piping

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Policy Considerations

- Approving LBB for GSI-191 would be inconsistent with defense-in-depth principles
  - Initiating event for accidents included in a plant's licensing analyses should not result in core damage in the absence of additional independent failures
  - Independence of prevention and mitigation – should minimize likelihood that a single cause results in failure of a prevention and mitigation feature
- Approving LBB for GSI-191 would be inconsistent with the proposed 10 CFR 50.46a regarding ECCS performance
  - 10 CFR 50.46a requires ECCS to have capability to mitigate the full spectrum of LOCAs as directed by the Commission in SRM dated July 1, 2004 related to SECY-04-0037
  - Allowing LBB to be used as the basis for not further modifying sump screens or for not removing sources of debris may prevent the ECCS system from performing its design function, which is contrary to licensees being able to "successfully mitigate the full spectrum of LOCAs"

Policy Considerations (Cont'd)

- Policy decision to expand GDC 4 to allow credit for GSI-191 would presumably include a Commission decision that the change:
  - would not result in an unacceptable reduction in defense-in-depth
  - is appropriate even though there is no perceived safety benefit
  - would not result in unintended consequences (e.g., unacceptable precedent for the use of LBB)
- Technical basis for expanding GDC-4 in the presence of PWSCC would need to be approved by the Commission
- Application of GDC-4 to GSI-191 would require revising the Statement of Considerations for GDC-4, revising the rule, and/or issuing exemptions

Recommendations

- Staff does not recommend that GDC-4 (LBB) be applied to sump evaluations to resolve the GSI-191 issue for the following reasons:
  - Large reduction in defense-in-depth for ECCS system performance that is inconsistent with defense-in-depth principles
  - Inconsistent with the intent of GDC-4 because there would be no corresponding safety benefit and the concern of local versus global dynamic effects
  - LBB credit for a global effect might set a precedent for other areas of plant design
  - PWSCC concerns in LBB piping
  - Inconsistent with risk-informed ECCS rulemaking of 10 CFR 50.46a that represents current NRC staff thinking on risk-informing ECCS regulations

Risk-Informed Considerations for GSI-191

Presented by:
Tim Collins/Stephen Dinsmore
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Presented to:
Subcommittee on Thermal-hydraulic Phenomena
Advisory Committee on Reactor Safeguards
September 7, 2010

Risk-Informing GSI-191

- Staff recommends a risk-informed approach to GSI-191 resolution
  - Address more likely (higher risk) events in short term
  - Address less likely events in longer term
  - Apply Commission decision on 10 CFR 50.46a rulemaking (risk-informing of Emergency Core Cooling System (ECCS) requirements)

Regulatory Guide 1.174 Guidelines

- Risk-informed resolution should have
  - Acceptable change in risk
  - Maintenance of sufficient defense-in-depth (DID)
  - Safety margins
  - Monitoring program

Challenges to Risk-Informing GSI-191

- Application of risk-informed methods is complicated by current limitations in phenomenological modeling
  - Key phenomenological models are either simplified and bounding (e.g., debris generation and transport) rather than realistic, or do not exist (e.g., debris bed head loss)

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Issue: Change in Risk

- Bounding estimates indicate significant risk contribution for plants with high fiber or thin bed potential and unproven strainer capability:
  - Medium (2 – 6 inch) break probability ~ $5x10^{-5}$/year
  - Recirculation required
  - Bounding sump clogging probability = 1.0
  - Recovery options limited (backflush, extended injection)
- Current limitations in phenomenological modeling make development of realistic "probability of clogging" model not feasible
- Medium breaks do not satisfy Δrisk criterion

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Protecting People and the Environment

Issue: Defense-in-Depth

- Loss of coolant accidents (LOCAs) of all sizes must be mitigated
- Sufficient DID would not be maintained with unrecoverable sump failure rate of 1.0 even if Δrisk criterion is met
  - Protection would be solely based on initiating event not occurring
  - Loss of systems that prevent core damage and degradation of systems that mitigate consequences (containment spray) would result

Experience in Risk-Informing GSI-191

- In 2004 staff endorsed an NEI-proposed risk-informed methodology (Section 6 of NEI 04-07) modeled on then-current proposed 10 CFR 50.46a
- No licensee implemented aspects of method that require risk calculations
  - Expectation of successful strainer testing
  - Lack of phenomenological models
  - Would require exemptions from current regulations for most resolutions

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Proposed 10 CFR 50.46a

- Proposed rule represents current staff thinking on risk-informing ECCS regulation
- Single-sided area of largest attached pipe (transition break size) is largest LOCA analyzed as a design basis accident (DBA)
- Mitigation analysis for larger LOCAs up to the double-ended break of the largest pipe is still required but can assume:
  - Offsite power
  - No single failure
  - Non-safety equipment
- Enabled changes to licensing bases must be risk-informed with very small risk impact

Impact on GSI-191

- Affords flexibility of using nonsafety systems (e.g., backflush) for beyond-DBA LOCAs
- Potential (limited) benefit for debris source term
  - Less rigor for analysis beyond DBA
- Refined test approaches (zone of influence, settling credit) and/or insulation replacements still likely needed for some plants
  - Breaks below transition break size unaffected by proposed rule and potentially problematic for some plants
  - Could reduce scope of insulation changeout for plants limited by larger breaks

Implementation of 50.46a for GSI-191

- Licensee must demonstrate
  - Applicability of underlying basis for rule
  - Risk-informed criteria must be met (~ RG 1.174)
  - Leak detection system adequacy
- Add technical specifications to identify any non-safety equipment relied upon to mitigate beyond-DBA LOCAs
- Injection phase ECCS models and analyses not impacted by 50.46a application to GSI-191

10 CFR 50.46a Continuing Requirements

- Every 4 years reconfirm that changes made to plant have not invalidated technical basis for the rule
- Limit operation in an unanalyzed condition (unavailability of systems and components credited to mitigate non-DBA LOCA) to less than 14 days in any 12-month period

10 CFR 50.46a Schedule

- Final rule to Commission this December
- Implementing guidance 12 months after Commission approval of rule
  - Supports staff-recommended option for GSI-191 closure

Summary: Risk-Informed Considerations

- Sump issue remains a safety issue for unresolved plants
- SECY-10-0113 recommendation is risk-informed consistent with
  - RG 1.174
  - Current state of phenomenological knowledge
  - Current thinking on risk-informed ECCS requirements (proposed 10 CFR 50.46a)
- 50.46a would facilitate large-break LOCA resolution but is not an “analysis only” solution
- Risk-informed implementation dependent on Commission decision on 50.46a

Summary Presentation
GSI-191 Closure Options

Presented by:
Christopher Hott/Michael Scott
Office of Nuclear Reactor Regulation

Presented to:
Subcommittee on Thermal-hydraulic Phenomena
Advisory Committee on Reactor Safeguards
September 7, 2010

Conclusion

- Sump issue remains a safety issue for unresolved plants
- Staff-recommended approach for issue resolution
  - Maintain current integrated review process
  - Revisit GSI-191 risk tools for evaluating larger LOCAs
  - Set near-term resolution schedule for smaller LOCAs, and longer-term schedule for the less likely larger LOCAs
  - Resolve in-vessel effects as part of GSI-191

Advantages of Recommended Approach

- Reasonably near-term resolution of an issue the staff sees as significant
- Allows time for additional attempts to refine evaluation methodology
- Maintains sufficient defense-in-depth (DID)
- Incorporates available risk insights into evaluations and resolution schedule
- Continues demonstrably successful issue resolution process
- Contains checks and balances to reduce likelihood of staff requiring excess conservatism
- Implementation schedule is risk-informed and takes into account the amount of planning and effort required for licensee implementation

LBB Credit not Recommended

- Large reduction in DID that is inconsistent with DID principles in that core cooling and containment spray might both be lost without any additional failures if a rupture in LBB-qualified piping occurs
- Inconsistent with intent of GDC-4 because there is no corresponding safety benefit as described in the Statement of Considerations of the rule
- Leak-before-break (LBB) credit for a global effect might set a precedent for other areas of plant design
- Primary water stress corrosion cracking concerns in LBB piping
- Inconsistent with proposed 10 CFR 50.46a rulemaking, which represents current staff thinking on risk-informing ECCS regulations

GSI-191 RESOLUTION OPTIONS

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September 7, 2010

NUCLEAR ENERGY INSTITUTE

SECY-10-0113 RESOLUTION OPTIONS

- **Option 1 - Maintain the current holistic integrated resolution process for remaining plants including evaluating new refinement models**
  a) Set a near-term schedule for licensees to address the full spectrum of LOCAs
  b) Set a near-term schedule for smaller LOCAs, and set a longer term schedule for the less likely LOCAs
  c) Do not set a schedule for licensees to address remaining issues
- **Option 2 - Develop additional risk-informed implementing guidance for GSI-191**
  a) Expand limited risk-informed guidance in Section 6 of the SE for NEI 04-07
  b) Generate new guidance assuming the that proposed 10 CFR 50.46a is approved
- **Option 3 - Allow application of the GDC-4 exclusion of jet effects to debris generation**
- NRC staff recommends Option 2 in combination with Option 1.b

Industry Recommendations

- The industry recommends Option 2 and Option 3 in combination with Option 1.b.
- Industry agrees that design basis for more likely breaks (small breaks) should be met using deterministic criteria and methods acceptable to the NRC
  - Schedule should accommodate ongoing efforts to refine ZOI values, settlement credit in strainer testing and in-vessel effects

Industry Recommendations

- All risk-informed options to address low-likelihood break should be pursued
  - Expand risk-informed guidance in current SE on Section 6 of NEI 04-07 (Option 2a)
  - Pursue approval of 10 CFR 50.46a and generate new guidance (Option 2b)
  - Allow application of GDC-4 (Option 3)

NEI

Industry Recommendations

- **Option 2a – Expansion of NEI 04-07 Section 6**
  - Section 6 in place currently with limited relaxation of known conservatisms
  - Future value dependent on “separation” between guidance applied to small breaks and large breaks
  - Schedule for development and application of expanded guidance unknown

Industry Recommendations

- Option 2b - Pursue approval of 10 CFR 50.46a and generate new guidance
  - Greatest value in 10 CFR 50.46a comes from risk-informed changes enabled by rule that are not related to GSI-191
  - The perceived value and subsequent plant interest varies by plant
  - Significantly extends schedule for closure

Industry Recommendations

- **Option 3 - Allow application of GDC-4**
  - **Provide means to address unlikely breaks in a manner that is risk-informed and complies with regulatory requirements**
  - **Application by plants considered closed permits recovery of operational margins**
  - **Guidance currently available and enables quick staff review and closure**

NEI

Option 3
Allow application of GDC-4

- **Option not recommended by NRC staff**
- *NRC Staff Reason 1: Application to LOCA-generated debris is not the intent of the current GDC-4 rule*
- **Application to LOCA-generated debris is within the scope and intent of the current GDC-4 rule**
  - **Debris generation is a direct consequence of local dynamic effects excluded from postulated breaks in LBB qualified piping**
  - **Debris generation is not a global phenomenon**
  - **Safety benefit of GDC-4 rule change addressed worker safety and plant safety benefits associated with removal of pipe whip restraints and jet impingement shields**

NEI

Option 3

- Debris generation is not a global phenomenon
  - The specific functional and performance requirements retained under GDC-4 (i.e. Global Phenomena) are (53FR11311):
    - For containments: Global loads and environments associated with postulated pipe ruptures, including pressurizations, internal flooding, and elevated temperatures
    - For ECCS: Heat removal and mass replacement capacity needed because of postulated pipe ruptures
    - For EQ: Pressure, temperature, flooding level, humidity, chemical environment, and radiation resulting from postulated pipe ruptures

NEI

Option 3

- *NRC Staff Reason 2: Application of LBB to LOCA-generated debris is a detriment to defense-in-depth principles and would require Commission approval*
  - **Impacts on plant safety, worker safety and defense-in-depth were evaluated under the original rule change that allowed removal of pipe whip restraints and jet impingement shields**
  - **Discrete evaluation of impact on safety and defense-in-depth is not precursory requirement for application of the rule**

NEI

Option 3

- NRC Staff Reason 3: Primary water stress-corrosion cracking (PWSCC) is a concern
  - **The industry and NRC have made significant progress in resolving PWSCC in PWRs**
  - **Mitigation efforts include installing weld overlays and mechanical stress improvements**
- NRC Staff Reason 4: ECCS functional performance is directly affected by the containment sump performance
  - **Debris generation is a result of a local dynamic effect excluded under GDC-4**
  - **While debris generation can impact ECCS operation, impacts on ECCS are not unique to debris generation and were acknowledged in the rule**
  - **Debris generation and its impact is not a global phenomena**

Missing Option 4

- SECY-10-0113 is silent on alternative design modifications as means to address GSI-191
  - Buffer removal significantly reduces chemical precipitates
  - Water management options, including:
    - Design modification to eliminate containment spray actuation on LOCA
  - Strainer backflush capability

Application of Option 3 (GDC-4) to GSI 191 Closure

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September 7, 2010

Application Of Option 3 (GDC-4) To GSI-191 Closure

- General discussion and background of Option 3 (GDC-4)
- Compare and contrast to Option 2b (10CFR50.46a)
- Option 3 (GDC-4) closure example using South Texas Project (STP) information
- Conclusion

Option 3 (GDC-4)

- GDC-4 States:

  "... dynamic effects associated with postulated pipe ruptures in nuclear power units may be excluded from the design basis when analyses reviewed and approved by the Commission demonstrate that the probability of fluid system piping rupture is extremely low under conditions consistent with the design basis for the piping."

- Application of LBB is desired to provide expedient means to demonstrate compliance in a way that reduces cost and worker impact

Advantages of Option 3 to Option 2b

Option 3 (GDC-4)	Option 2b (50.46a)
Some application guidance needed	Requires additional implementation guidance
Implemented by Commission decision rather than new rule-making	New rule making needed

Advantages of Option 3 to Option 2b

Option 3 (GDC-4)	Option 2b (50.46a)
No additional generic testing needed	Potential for additional generic testing
Shorter timeframe for closure of GSI-191	Longer time to closure due to rule making and implementation guidance development
More certainty for NRC and industry towards resolution	Final rule wording and implementation guidance not certain

Other Benefits of Option 3 (GDC-4)

- Precedent: LBB previously used for closure of Unresolved Safety Issue A-2
- Reduces possibility of large dose impact modifications
- Appropriate use of NRC and industry resources based on remaining safety significance

Risk Impact - STP

- The core damage frequency at STP due to large LOCA is currently 9.4E-09.
- This is based on NUREG-1829 initiating event frequency for the 31 inch LLOCA initiating event frequency of 2.9E-08
- A sensitivity case study was performed on the impact of a total sump plugging event on CDF.

Risk Impact - STP

- Total sump plugging event probabilities were used to determine the impact on the large LOCA CDF
  - For probability of 1.0 E-05, the CDF is 9.4 E-09.
  - For a probability of 1.0 E-03, the CDF is 1.1 E-08
  - For a probability of 1.0 E-02, the CDF is 3.3 E-08
- A PWROG sensitivity study showed comparable results

Applying Option 3 (GDC-4) to GSI-191

- Licensee would demonstrate that strainer qualification addresses limiting debris generation using methods accepted by NRC
- Results provided as a license amendment request to NRC
  - Identification of LBB qualified piping
  - Determination of limiting debris generation from non-LBB piping
  - Discussion of defense-in-depth measures and actions to maintain defense-in-depth

Applying Option 3 (GDC-4) to GSI-191

- Identify and evaluate the piping location based on the SE of NEI 04-07 that yields:
  - The maximum amount of debris that is transported to the sump screen
  - The worst combination of debris mixes that are transported to the sump screen

STP GDC-4 Submittal

- LBB piping is eliminated from consideration for debris generation
- STP largest size break to consider is the residual heat removal line (12 inch)

STP GDC- 4 Submittal

- Use the NEI and NRC methodology to determine the worst case break locations using the 12 inch RHR lines and smaller sizes
- Use the NEI and NRC methodology to determine the worst case small break locations (no change from current evaluation)

STP GDC- 4 Submittal

- Debris Generation Determination
  - Use methodology from SE of NEI 04-07
  - Use Zone of Influence (ZOI) accepted by NRC
- Current estimate at STP is 125 cu ft of fiberglass fines at sump

STP GDC- 4 Submittal

- Compare to current strainer testing
  - Test in July 2008 was successful with 77 cubic feet fiberglass fines based on WCAP reduced ZOI
  - New estimated total of 125 cubic feet
  - The July 2008 test included chemical effects from Marinite insulation which has been replaced with Nukon
  - Reduced chemical loading is expected to offset increases in fiber and particulates
- New strainer testing will be required using NRC approved protocol

STP GDC- 4 Submittal

- Margin Management
  - New modifications may be considered to improve margin on NPSH capability
    - Selected fiberglass insulation replacement
    - Banding of fiberglass insulation
    - Additional strainers
  - Modification scope and dose impact would be much less than other options

Conclusion

- Option 3 (GDC-4) provides a closure methodology for GSI-191 that is:
  - Timely because there is no rulemaking and guidance is available
  - Appropriately addresses incremental risk
  - Minimizes radiation dose across the industry
  - Provides a means to regain margin