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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

SUBCOMMITTEE ON FUTURE PLANT DESIGNS

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FRIDAY, JULY 18, 2003

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MONROEVILLE, PENNSYLVANIA

The Subcommittee met at the Westinghouse Energy Center, 4350 Northern Pike, Monroeville, PA, at 1:00 p.m., Thomas Kress, Chairman, presiding.

SUBCOMMITTEE MEMBERS:

THOMAS KRESS - CHAIRMAN

GRAHAM WALLIS - MEMBER

JOHN SIEBER - MEMBER

GRAHAM LEITCH - MEMBER

VICTOR RANSOM - MEMBER

F. PETER FORD - MEMBER

ALSO PRESENT:

MEDHAT EL-ZEFTAWY
MIKE CORLETTI
TERRY SCHULZ
ED CUMMINS
TOM HAYES
DAN FREDERICK
RALPH CARUSO
JIM SCOBEL
SELIM SANCAKTAR
JUN LI
JIM GRESHAM
M. KHATIB-RAHBAR
MIKE ZAVISCA
SUD BASU
H ESMAILI
JOELLE STAREFOS
RICHARD ORR
JOHN SEGALA
RON VIJUK
TIM ANDREYCHECK
JIM GROVER
WARREN BAMFORD
BOB FULD

C-O-N-T-E-N-T-S

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

8:35 a.m.

CHAIRMAN KRESS: This is the second day of the Advanced Reactor Subcommittee meeting. I don't have any introductory comments, so we are starting with the DSER open items and I guess the Staff is leading off.

MS. STAREFOS: Good morning. My name is Joelle Starefos, I'm one of the project managers on the AP1000 project in the Office of Nuclear Reactor Regulation.

With me today is John Segala, our senior project manager and lead for the AP1000 project. Our staff is -- part of our staff is going to be available via the teleconference today.

They have been emailed the slides so they should be able to follow along with what we are discussing.

CHAIRMAN KRESS: How many staff do we have working with this?

MS. STAREFOS: We have more than 50 reviewers on this project. We also have support from NSER, which is our security section, and research.

MEMBER WALLIS: That is the entire AP1000, or just your part?

CHAIRMAN KRESS: That is all.

MS. STAREFOS: The entire --

MEMBER WALLIS: That is the whole thing?

MS. STAREFOS: The whole thing, yes. I thought I would start out with a current review status. We issue the DSER on June 16, with 174 open items.

After a 14 day proprietary review by Westinghouse the DSER was made public on July 1st with no changes. We were working to resolve -- right now we are working to resolve the open items.

We have engaged Westinghouse on 82 of the 174 open items. We have resolved 5 of the open items, and we are satisfied with Westinghouse's responses on 31 of the open items. Those have now been considered confirmatory.

We have characterized these items as open, confirmatory, or resolved. Confirmatory being items that we're satisfied with the response. However, we still expect to see changes in the DCD, or associated WCAP or other licensing document prior to determining that resolution is complete.

The schedule for the FSER, or the final safety analysis, or evaluation report, I apologize, it should be evaluation report, is September 2004. We

are in the process of reassessing the schedule.

What we discussed, with Westinghouse, I believe as you saw earlier, they've got a little bit more of an aggressive schedule to completion than we had originally committed to, and we have agreed to review our schedule after issuance of the DSER open items, and have had further discussions with them on completion dates, when we determine the significance and length of completion of our DSER open items.

CHAIRMAN KRESS: That is the time that the ACRS ought to have its final letter, right after you get the FSER?

MS. STAREFOS: I expect that would be the time frame for the final discussion with ACRS full Committee.

I went ahead and put up a quick five chapter tally of the open items. I would point out that the number of open items in a given chapter may not be an accurate indicator of the scope of work remaining for the Staff and Westinghouse to reach resolution of any of these items.

I would point out that there are three that look a little bit like outliers, chapter 3, structures, component and equipment. The significant number of issues there are seismic, and we have some

wind and tornado loading issues that need to be completed with an additional review.

And I will discuss, a little bit about that, in a few minutes. Chapter 14 our verification programs. A good chunk of those were ITAAC, inspections, tests, analysis and acceptance criteria, that the Staff had either questions or additional ITAAC that they recommended.

Chapter 19, which was severe accidents, the majority of those are PRA, and there are also some seismic margin issues associated with those.

MEMBER WALLIS: Now, I'm not sure this number is really significant. We spent a day and a half here on, I suppose, chapter 6.

MS. STAREFOS: Absolutely, and that is why we --

MEMBER WALLIS: -- identify something like half a dozen unresolved items right there, without -- and they seem to be significant items.

MS. STAREFOS: Absolutely, Dr. Wallis, and that is why I prefaced by saying that the number is really not a direct indicator of the remaining work, or major issues.

And I will discuss that a little bit in the next slides. What I went ahead and did was,

instead of discussing each of the 174 open items, we thought it was more appropriate to bin them by issues.

So I'm going to speak about some of the more major issues, or --

MEMBER WALLIS: These folks can't even write an introduction without open items?

(Laughter.)

MS. STAREFOS: I do address that.

MR. CUMMINS: We are trying to get better.

MS. STAREFOS: Those are general staff open items that I do address that --

(Laughter.)

MS. STAREFOS: The supplemental DSER sections, we are planning to issue supplemental DSERs on the following chapters or sections. There were a number of different reasons for that.

One of the reasons was documentation of our AP1000 FSER. It needs to stand on its own for rulemaking, for part 52 rulemaking. And in order to do that we need to ensure that we document all of the information pertinent to AP1000 that was included in the AP600 DCDs, and in any other information that we use to support the AP1000 and directly tie that back to its appropriateness for the AP1000.

So you will see that there is a pretty

significant open item in chapter 21 to document that, prior to issuance of the FSER. Section 14.2 of the initial test program, we had additional work that we needed to do with technical staff support. So that also is still remaining open.

Security, I will talk about a little bit in another slide, but that is also a significant review that is under way at this time. Leak before break, we had an issue that has come up sort of late in the process, before the DSER was issued.

I will speak to that a little bit in here, but I understand that Westinghouse has a presentation specifically on that, to discuss that. And when Westinghouse makes that presentation I'm hoping that our technical staff will be available to answer any questions from the NRC staff.

And wind and tornado loadings, that was another issue that we had not completed the review and, as such, have additional work to do. We do expect to issue supplemental DSERs on those.

MEMBER LEITCH: The initial test program seems not to include those things that one might call pre-op tests, or start-up tests. Is that correct, or a description of those tests refer to the COL stage?

MS. STAREFOS: No, that is one of the

items that we are addressing right now. Both of those should be included, and if appropriate, associated with that prior to the agency giving approval, the Commission giving approval to go forward for an applicant, or licensee at that point.

We need to make sure that all of them are incorporated in the ITAAC appropriately. But our technical review, at this time, is not complete. We need to have our technical reviewers verify that those systems, structures and components that have testing, the testing is appropriate and complete for those items. And that is part of our additional review.

MEMBER LEITCH: And that would be done at this stage?

MS. STAREFOS: Yes, prior to the FSER.

MEMBER LEITCH: Yes, right.

MR. SEGALA: This is John Segala. For clarification, our area of review on that item does include the preoperational testing that we have to make sure that we have that correctly described, so that that can be done when the plant is built.

MEMBER LEITCH: Okay, thanks.

CHAIRMAN KRESS: Let me ask you a procedural question while you are doing that. Let's just, as a hypothetical example, talk about squib

valve reliability.

Now, suppose it was -- you guys came to the judgement that what they have now is not an adequate data base on which to judge the reliability of the squib valve.

Now, in order to certify the plant you may say something like you have to have a monitoring program, and look at these squib valves, as you go along. And, you know, they have one already that they've outlined to us.

How does that end up being part of the certification, is that going to DAC, or ITAAC, or?

MS. STAREFOS: I would expect that to be a COL action item.

CHAIRMAN KRESS: A COL action item?

MS. STAREFOS: Right. That would be deferred to the COL stage.

CHAIRMAN KRESS: Where is that spelled out in the process to certify?

MS. STAREFOS: We identify all the COL action items in -- well, they will be identified in the FSER.

CHAIRMAN KRESS: As part of the FSER?

MS. STAREFOS: That is correct, and also in the DCD. We would expect them to update the DCD to

reflect any of those that the Staff may find necessary to approve the design.

CHAIRMAN KRESS: And, similarly, if there were materials issue, and you had to do a certain inspection, or monitoring, that would show up in places like that, too?

MS. STAREFOS: Yes, it would depend. If it was something that needed to be done prior to approval, or licensing, we would -- if it was in a Part 52 stage, we would do it under an ITAAC, and that would be identified and enumerated in the EFSER, as well.

CHAIRMAN KRESS: Okay, thank you.

MS. STAREFOS: You are welcome.

MEMBER LEITCH: Just another question about the initial test program. Would Chapter 14 describe -- I would assume, let's say there is some distinction between first of a kind testing, that would be done on first unit built, and subsequent units.

MS. STAREFOS: That is correct.

MEMBER LEITCH: Does Chapter 14 differentiate between those two?

MS. STAREFOS: Yes, it does. And it identifies first testing, and first replant testing,

which is the way that Westinghouse went with certain tests they wanted to get more than one plant, but not continue through the --

MR. CUMMINS: We had some help with the Staff in identifying those.

MS. STAREFOS: The next slide I have discussed kind of my general open items from DSER chapter 1, this goes to Dr. Wallis' comment about the introduction.

These are three issues that we identified, that are sort of generic in nature, that the Staff needed to complete prior to issuance of the FSER. The first being we needed to ensure that all the revisions of the design control document, the DCD, were reviewed prior to making a determination, safety determination.

When we were in the DSER stage, we had made a decision that the Staff would review through rev 3. So anything you see in the DSER, unless it is otherwise enumerated in there, is based on DCD rev 3.

However, we do need -- we've currently gotten in through rev 6 now, and we do need to ensure that we've addressed all of the revs prior to issuance of the FSAR.

And we will have to discuss how, logistically, we are going to do that, in the future,

when it gets closer. But that will happen prior to the FSAR.

The second issue had to do with identification of tier 2 star information. It needs to be completed prior to the FSER issuance.

CHAIRMAN KRESS: We have some -- haven't been through the certification before. Could you clarify what you mean by tier 1 and tier 2 for those people?

MS. STAREFOS: Certainly. The tier 1 information is information that will actually be pulled up into the Rule. It will be an Appendix to Part 52, and it is required to be done prior to certification, I'm sorry, prior to licensing.

Prior to approval to load fuel from the Commission. That information is going to be in appendix, I believe it is appendix delta for AP1000, I believe that has already been identified.

That will be done through the rulemaking process. That is tier 1. Tier 2 information is information that your typical safety analysis report type of information. That information is information that a future COL applicant, or licensee, will be able to change, using a 50.59 like process.

We also have a similar process in part 52

to allow them to make certain changes if the COL applicant makes application and decides on AP1000.

The third is tier 2 star information. The tier 2 star is somewhere between a tier 2 and a tier 1. It was information that we didn't see -- we didn't want to necessarily put in the rules because it may be something like an ASME code that they have -- that they wanted to follow, and then we expect that there will be updates, or a better way to do that.

We wanted to allow the NRC approval to make those changes. So those tier 2 star information needs NRC approval to be changed, and is identified as italicized information in the DCD, and will also be identified as italicized information for any of that which we pull up into the FSER to make our safety evaluation.

That is pretty much our open item. We need to make sure that we have incorporated all of the italicized information, or all of the information that we have pulled up into the FSER, that is tier 2 star, is identified as such, in our FSER.

So it is something that we need to focus on.

MEMBER FORD: So if there is a new, for instance, materials degradation phenomena, which had

not been addressed by either the Staff, nor the applicant, but which would need to be done some time in the process, that would be a tier 2, is that correct? There is a process --

MS. STAREFOS: Not necessarily. The tier 2 star is information that the applicant has identified in their DCD. So when they present that to us they said, this is stuff that we feel strongly about we are not going to change.

Of course I'm sure some of that was with help from the Staff.

MR. CUMMINS: Yes, it really was -- on AP600, at the end of the licensing on AP600, the Staff and Westinghouse sat down and went through the whole DCD, and the FSAR, for what are the most important things that we don't want you to make a change with a 50.59 process, that you have to come back to us.

And a lot of it was related to the version of the Code, the ASME, the things that one might think that maybe the Staff had wanted to tier 1 but it wasn't appropriate because the burden of the approved code -- that the Staff would accept changes.

So they wanted to allow it to change, but it was still very important, and so it is really changes that can't be made with just a 50.59 process.

MR. SEGALA: In terms of your issue, you know, once this is put into the Rule, and then a plant adopts it, if some new degradation mechanism comes up, we will have to handle that in the normal process, either issue an order, or issue a generic communication, or something like that to get them to address that new issue.

MEMBER FORD: It sounds kind of late in the process. But we will discuss it when it comes up.

MR. CUMMINS: I think that maybe the nature of your question is, how do you have a list of actions, future actions, that the applicant, or some future applicant must address.

And there is really two ways to do that. There is the COL items, and we have something like 170 of them, which are open items, if you will, that combined operating license applicant has to address when they come in for the combined operating license.

And the other one, which is a little tougher, and a lot more sensitive policy-wise is a DAC, which is in ITAAC, which really is a process where you provide design and the NRC reviews it at the level of tier 1.

And the examples that we have of ITAAC, like that, are basically to the main control room

design, where we have a process, not a design. And INC design. Because the idea there was technology could change, and instead of licensing a product, you license the process.

MEMBER WALLIS: I have a question for you. I haven't had a chance to look at this disc yet. And if I want to figure out what you are doing, I look at the disc.

MS. STAREFOS: I'm sorry?

MEMBER WALLIS: I haven't had a chance to look at this disc, which is the --

MS. STAREFOS: Okay, yes.

MEMBER WALLIS: So I have no idea what is in it. When I open it up I see these chapters, and I can find these open items?

MS. STAREFOS: Yes, sir.

MEMBER WALLIS: And then I have to go to the DCD to find out what it is all about?

MS. STAREFOS: There should be some description of our concern --

MEMBER WALLIS: Do I have the DCD somewhere?

MR. CUMMINS: Yes, I can give you rev 6.

MEMBER WALLIS: Maybe you should do that today.

MR. CUMMINS: The other thing that you need is the responses to the open items.

MEMBER WALLIS: That is somewhere else?

MR. CUMMINS: There have been six letters, so far, that Westinghouse has responded -- I can put it all on a disk.

MEMBER WALLIS: That would really help. And this is going to be something I can open in my computer?

MEMBER SIEBER: As opposed to General Electric's practice to give you a disk and you can't open it.

MR. SEGALA: To give you an overview, you can go to section 1.6, and we have a brief discussion of every open item, and every confirmatory item. And it is only 30 pages long, or something like that.

So you can get a flavor for the open item, and then go to that chapter to get more details in that item, if you are interested.

MS. STAREFOS: We also have additional information on our website. We are trying to maintain that updated, and we are catching up. But unfortunately I don't have that.

MEMBER WALLIS: If I find an open item has to do with some of the things we discussed on the

first day, what do I find, if I look in the Westinghouse document do I find sort of words where it says it is all fine, and here is a code.

Or do I find enough so that I can understand what is really behind it, such as the stuff that was revealed when we talked here?

MR. CUMMINS: I think typically what you find is a question from the Staff, which we call an RAI, a Westinghouse response. They are all words. sometimes there is some analysis, because there may be some analysis.

But, generally speaking that analysis, because the Staff wants it more permanently documented, gets incorporated in future revisions of the DCD, and probably has already been incorporated if it came from an RAI.

MEMBER SIEBER: The practice, over the last four years, has been to have these job books where the real analysis is, and then you have a summary, or a description of that, with a conclusion as the official document.

Is that really the way it works?

MR. CUMMINS: Yes, Westinghouse has what we call calculations, where the real analysis is. And we provide a summary to the Staff, and sometimes a

summary is not enough, and the Staff wants more, so we give them some more.

And they come and look at it --

MEMBER SIEBER: Which is more often the case.

MEMBER WALLIS: They can do that, but we can't do that so easily. And that is another problem it is a slew --

MR. CORLETTI: It is a slew, and you heard we are revising a half a slew.

MEMBER WALLIS: So we are going to have CDs of all of those, too, so that we can follow, if you really want to go into some item, we can follow your logic and everything?

MR. CORLETTI: Yes, we have made CDs that are all the AP1000 WCAS, and we can put those on a CD as well.

MEMBER WALLIS: Are you going to give them to us --

CHAIRMAN KRESS: Coordinate through MED

MR. CORLETTI: It is a room full of stuff.

MEMBER WALLIS: I don't want a room full.

MR. SEGALA: Another thing that may be helpful, some sort of link between the open item and the RAI, it is not always obvious how to get from one

to the next.

MR. CORLETTI: Link these CDs, you click on the open item and it takes you to the next -- we did that for Dana Powers, we gave him a link that was 30 boxes of stuff that was all linked. That requires some upfront work. I don't have it right now, but we can --

CHAIRMAN KRESS: When did we rename the FSAR to a DCD?

MR. CORLETTI: At the end of the process of the FSAR, there was a process that turned the SAR into a DCD. So the Staff suggested why don't you just work with that, so you can shorten that process.

And the main difference is the tier 2 star information. So we are working with that to try to gain overall efficiency. Now, when a plant would reference building AP1000 records, they take our DCD, and they take our first 18, 19 chapters, or whatever that is. And that has become their FSAR, their final safety analysis report.

CHAIRMAN KRESS: Would that constitute the design basis, then, of your plant, the DCD?

MR. CORLETTI: Essentially, you have the licensing basis.

MR. ZAVISCA: Let me ask, for tier 1

information, is that part of the ACR subcooled?

MS. STAREFOS: I am not sure --

CHAIRMAN KRESS: We don't usually look at tier 1 stuff.

MS. STAREFOS: The question, Joe, was whether or not the ACRS has involvement in the ITAAC, or tier 1 information, and approval of that, during their letter, for the letter?

MR. WILSON: This is Jerry Wilson. The answer is yes, in the past ACRS has looked at the issue of what information is taken from tier 2 and put into tier 1, and becomes ITAAC.

MR. ZAVISCA: Is that going to be done after the FSAR?

MR. WILSON: I think we would like the Committee to consider that prior, as part of the FSAR review. But there will be a rulemaking, and the final decision on those matters will be handled through rulemaking, and we will come before the ACRS with our proposed rule.

MS. STAREFOS: Thank you, Jerry. I will get to the last bullet on the slide, identification and incorporation of the combined license action items in the FSAR or DCD. Additional reviews may come up with more of this items as our review process is

completed.

But the intent is to capture the COL action items in our FSAR, and ensure that Westinghouse makes the appropriate changes in their DCD.

And that brings me into the combined license items. There are numerous combined license action items, open items I should say, in this DSER, 18 to be specific.

Many of those open items propose new COL action items, or changes to the existing COL action items. And, again, as I stated additional items may be identified as the reviews are completed.

Another area where we had a numerous amount of open items was the ITAAC, the inspection, test, analysis and acceptance criteria. There are, approximately, 35 -- well, there are 35, approximately 15 of those are still open.

The remaining have been resolved, or the Staff is satisfied with Westinghouse's response such that we have considered them confirmatory at this point.

Quality assurance, we have two specific open items that I wanted to bring to your attention. One is an inspection that we plan to do of the test control implementation of the QA program at Oregon

State University on the AP1000 facility.

As you heard in the thermal-hydraulic subcommittee, we are using the test data from that to support our evaluation of liquid entrainment and we wanted to ensure that the QA standards were appropriate, and that Oregon State was following the expectations there.

The next bullet is the inspection of the implementation of the projects, specific quality plan here at Westinghouse. We expect to come to this facility and look at their implementation during this AP1000 process to ensure that their QA plan was appropriate and implemented.

MEMBER LEITCH: I have a question about the quality status of the plant equipment. I'm not sure if this is exactly the place to bring it up. But it seems like the passive safety systems are safety related, and full quality assurance program is in place there.

And then there are other things that are not safety related. But I got the feeling, reading through this, that there was still an issue about exactly the quality status of what I will call the active systems.

Is that true? I'm talking about the

active systems.

MR. CORLETTI: In AP600 a significant amount of the review was on the regulatory treatment of non-safety systems. And there was an issue that was identified early, by the ACRS as well.

And it was really, given now that you have this new design of a passive plant, what should we do with the reactor systems that we've always thought as safety related, and the regulations were written around them being safety related.

So we did an -- there was a process set up which was the regulatory treatment of non-safety system, where we use PRA, and looked at the PRA importance and essentially -- and combined that with trying to asses the importance of the non-safety systems, as well as are there augmented inspection requirements.

Even though they are not safety related, can we do availability controls on the non-safety systems to make sure that they are good systems, and that they will be available? Because they do provide defense in depth.

For AP1000 we followed the same process. And I think one of the chapters is -- and one that we are very proud of, there are zero open items on that,

and we actually followed the same process, we used our PRA to see if there were any differences with the new -- with the AP1000, and actually one did.

We ended up the diverse actuation system had a little bit, the way I think the PRA fell out, had a little bit higher importance and we actually implemented an additional tech speech on the DAS as a result of that.

CHAIRMAN KRESS: Did you use the same importance measure, criteria, that you used for AP600?

MR. CORLETTI: Yes, we did. I think that was part of it, and can you meet the safety goals without the non-safety systems? So we did this focus PRA.

CHAIRMAN KRESS: Where you just didn't have, you put them to zero reliability --

MR. CORLETTI: You put them to zero, and you still meet the safety goals in your PRA. And if you couldn't, then you had to have one -- keep that in your non-safety system, until you can meet the safety goal. And those were the important -- and then it came out that part of the DAS fell into that category.

MEMBER LEITCH: So the passive systems are full Appendix-B 18 criteria and everyTHing. And then these other systems are --

MR. CORLETTI: Yes.

MEMBER LEITCH: -- some modified version of that depending upon the --

MR. CORLETTI: They tend to be non-safety related. However, they often, we have redundancy requirements, certain system level redundancies are in that. But they tend to be commercial grade.

We have these additional availability controls that are in our DCD that the owner/operator will have to agree that there are a certain amount and test them every so often to make sure they are available.

And they tend to be the systems you need to run the plant. So like the CBCS, you need to keep that operable to run your plant. So plants are going to maintain -- they have a high incentive to maintain them, anyway.

CHAIRMAN KRESS: I remember the debate was over what was meant by availability, control --

MEMBER LEITCH: Is there some term that we are using to call those things?

MR. CORLETTI: They were called defense in depth systems. But we don't have -- we haven't painted them all blue, they are not all -- we haven't categorized them quite that way, but we have

identified them as our systems that have availability controls.

MEMBER LEITCH: Thanks a lot.

CHAIRMAN KRESS: There is a letter of regulatory treatment of non-safety systems for ACRS that would be useful. I forget the time frame, but it goes --

MEMBER LEITCH: That was at the time of AP600, I guess.

MR. CORLETTI: Typically you categorize as quality group B, which there is quality group A, B, and they tend to be commercial, but maybe some additional -- high commercial, right. And that tends to be the way we categorize them.

MEMBER LEITCH: Okay, thanks.

MS. STAREFOS: The next slide -- security is one of our major open issues. It was identified, in our letter, as one of the two major issues that could impact completion of the review.

In light of everything that is going on today we are evaluating security on a different schedule, which we expect to mesh up to our FSER in the end.

In April and May of this year we provided the interim compensatory measures, and the revised

design basis threat to Westinghouse for their consideration.

In May of 2003 we met with them to discuss the information that we had provided, and later in May 2003 Westinghouse revised their design control document to defer their security plan to the COL applicant.

In June of this year Westinghouse provided a letter with an assessment of the impact of the ICMs, and the revised DVT on the AP1000 design. The Staff is currently reviewing the DCD against Part 73, the ICMS, and the revised DBT for design implications that are not site-specific. That review is ongoing at this time.

It is my understanding that there is a separate subcommittee that addresses security and although we don't have a date now, we --

MEMBER WALLIS: These issues are physical things, security issues, rather than procedural, these are physical things about access to places, or doors, and that sort of stuff?

MR. CUMMINS: Some of them are physical with access to places, yes. Many of them are process, number of guards, training of guards.

MEMBER WALLIS: That is likely to be a

variable thing, that we would refer to the COL, I would think.

MR. CUMMINS: Yes.

MEMBER SIEBER: Somebody in our staff can stop me if I'm asking the wrong question, but there is an issue in the security area of vulnerability of structures.

Is that one of the issues that is being looked at?

MS. STAREFOS: I would have to defer that question to Westinghouse.

MR. CUMMINS: It is not on either the ICMs, or the design basis --

MEMBER SIEBER: Yes, and it is not a design basis for any other plant. On the other hand it is an issue of concern, that I would presume that somebody is going to analyze at some point.

MEMBER WALLIS: I mean, it is almost like seismic.

MR. CORLETTI: Perhaps that would be best assessed in the security --

MEMBER SIEBER: Well, I'm on that subcommittee, so I will ask somebody.

MS. STAREFOS: The next slide is the leak before break issue. This is sort of a late breaking

issue that came up. There were two aspects of this.

One having to do with the Alloy 690/52/152 susceptibility to primary wash stress corrosion cracking. There is limited test data and operating experience, so the Staff had a lot of questions on that.

The Staff has discussed, with Westinghouse, the need for inspections and an understanding of sensitivity study margins to provide sufficient defense in depth to address the uncertainty of PWSCC.

The second issue has to do with piping stress analysis for the most limiting leak before break systems. The Staff is working to determine if the bounding limits are appropriate, and appropriately established in the preliminary analysis results, during the design certification phase.

The information that the Staff needs to make safety conclusions regarding that preliminary analysis results, have not yet been provided. But we are in the process of having meetings and discussions with Westinghouse, and we have plans for future meetings at Westinghouse to address both of these issues, the aspects of these issues, I should say.

The next one is sump performance. We have

staff concerns and open items regarding the debris loading of the IRWST, the recirculation screens, and debris that would come in through a reactor coolant system break.

The Staff will be available at 10:15, during a specific presentation that Westinghouse is going to give on sumps to address any questions that we have, specifically, on that.

But we recently audited the associated Westinghouse calculation, and we have identified that some of the assumptions of debris size, density and porosity, are not consistent with industry practices, so we still have more work to do in this area to determine, to come to resolution here.

CHAIRMAN KRESS: I think there are about five open items, in one form or another. And I guess we are going to hear about that whole discussion later this morning?

MR. CORLETTI: Yes, Terry Schulz will be here to make a presentation on that. We don't really have a good handle job on the inconsistencies with the best practices --?

MS. STAREFOS: Either yesterday or the day before --

MR. CORLETTI: We had a couple of

discussion with the Staff, but I think we are still working on it.

MS. STAREFOS: In an effort to provide you the greatest and latest, I don't have all the details on that. Hopefully our expert will be able to address that.

The structural and seismic designs, we identified 38 structural and seismic items. And I also included in that the section 19a, which is that last portion of the PRA in that 388 count, many of which require an audit of specific Westinghouse calculations to resolve.

One of the things that was identified in an April 2000 audit, was that the containment design was not completed. Based on yesterday's Westinghouse presentation, it sounds like Westinghouse is further along with that work.

However, the Staff still plans to follow-up with additional audit and review of this information prior to resolution.

The next is liquid entrainment. This was the second of two major issues that was identified in the letter --

MEMBER WALLIS: In the thermal-hydraulic we now have a staff that is able to make independent

calculations. In seismic, when they show you a picture which has all kinds of rebar here, or rebar there, and they assure you that now this is good enough, how do you know that it is good enough?

Do you do your own calculations, do you have some places for checking?

MR. SEGALA: Tom has a set of contractors that are helping him do the review, and they are doing a lot of audits. I'm not sure if they are doing independent calcs.

MR. CUMMINS: I'd say these contractors are pretty impressive.

MEMBER WALLIS: What do they do, though?

MR. CUMMINS: They do give us a hard time on our calculations. They certainly look at ours and have comments.

MR. CORLETTI: On AP600 they did a lot of independent calculations, I just don't know the extent.

MS. STAREFOS: The next slide, being liquid entrainment, as I was saying --

MR. CORLETTI: They are almost as challenging as the ACRS meetings, I would say.

MS. STAREFOS: Liquid entrainment, long term cooling, core swell and boron precipitation, the

liquid entrainment issue was identified as one of our major issues in a letter transmitting the DSER.

One of the items that could affect our completion of this review. We have had numerous discussions at ACRS, thermal-hydraulic subcommittee meetings, our latest being the last couple of days, on the 16th and 17th of July.

And it has provided a good technical exchange for the Staff regarding these issues. The Staff review will continue with independent analysis and review of the Westinghouse submittal.

We are not there yet, but it sounds like we are headed in the right direction, I hope. The next slide discussed probabilistic risk assessment, PRA. The reason I put this up here is because, primarily, we had so many open items in this area.

But as of our last conversations with our reviewers, there aren't any outlying significant big issues that we are concerned with at this point. We just have a lot of work left to do to resolve our issues, our items.

In January of 2003 we had an ACRS PRA Subcommittee meeting, and one of the questions or issues that was raised during that, was the ADS 4 squib valve reliability issue, which we discussed

yesterday.

In February of 2003 we had a PRA meeting between the Staff and Westinghouse to discuss RAIs, and are continuing to have interface to resolve the rest of these issues. Right now we have 24 PRA related open items.

There are some other issues, too. In an effort to try to look at the 14 and characterize them, I thought it was appropriate to give you a bigger picture of the issues that we had a lot of work left to resolve.

But we also have issues associated with combustible gas control, 10CFR50.44 is in the process of being changed, the Rule is being updated, and we are trying to determine the best way to go forward with the applicant -- well, the application and the request and the approach that the applicant took to address combustible gas control, in light of the fact that this Rule has not yet changed, and how we need to handle that.

And so we are working with that. Another issue was the short term atmospheric relative concentration values, also known as K over Q.

We are in the process, I guess Westinghouse is in the process of addressing some

changes that were very recent to Reg Guide 1.193. Those changes were made as late as June 2003.

So we still have some work to do there to try to look at Westinghouse's review of, and any changes that may come out of that review.

CHAIRMAN KRESS: Is Q an appropriate thing to put out to the COL stage, since it tends to be site specific?

MR. CORLETTI: I have a slide on that.

MS. STAREFOS: There were other things as well, such as some tech spec open items, dose analysis, turbine materials, technical support center habitability, communication systems, the initial test program, which we did talk a little bit about, fire protection, human factors, missile protection, reactor coolant pressure bounding materials, steam generator design.

Things of that nature that I wanted to mention because we do have open items, but at this time we don't see these as real significant issues.

MEMBER WALLIS: The question was when the -- the question had to do with when the Staff reviews the seismic analysis having to do with how much we've already put in here, and that sort of thing.

Do they do independent analysis in order

to confirm the validity of these things, or do they just look at Westinghouse's documents?

MR. CHENG: When we did this, we reviewed their design analysis, and design calculations. The Staff did not do any independent confirmatory analysis as we have done for AP600, because based on our review, the Westinghouse followed the SRP guidelines, so that is why we think it is acceptable.

We did not perform independent confirmatory analysis.

MS. STAREFOS: Thank you, Tom. I guess I'm at the summary. And I will try to say it simply, we are still resolving the DSER open items, and if there is any further questions?

CHAIRMAN KRESS: Do you use consultants in this review of the seismic issues?

MR. CHENG: Yes, we do use -- we used Dr. Constantino, and two of his associates, one is a Dr. Tsai. Both of them work with the Staff, and others, in advanced reactor review.

They have various experience in doing this review for the Staff.

CHAIRMAN KRESS: Do they write up their reviews in a report to you?

MR. CHENG: Yes.

CHAIRMAN KRESS: Can we get copies of those?

MR. CHENG: You mean the report written by them?

CHAIRMAN KRESS: Yes.

MR. CHENG: We converted that as DSER section. I can provide you the original write-up, if you need it.

CHAIRMAN KRESS: Yes, that is what we would like.

MS. STAREFOS: Thank you.

CHAIRMAN KRESS: Thank you.

MS. STAREFOS: There are no further questions, thank you, Tom.

MR. CHENG: Thank you.

MS. STAREFOS: Are there any further questions?

(No response.)

MS. STAREFOS: My presentation is complete, and I will turn it over to Mike. Thank you.

MR. CORLETTI: The next presentation is going to be on the -- I will try to minimize the repeat with Joelle's.

But, really, this is just identifying, of these issues, we think we have come to the Committee

with the thermal-hydraulic issues, pretty extensively, and probably the PRA as well.

Yesterday we had a talk on the seismic and structural issues with Richard Orr. Two issues that we are going to speak of today, the leak-before break materials issue, we have Warren Bamford, from our engineering services department, and he will speak to that.

We are also going to have a presentation later on sump performance issues by Terry Schulz. So I'm going to address the last four, real briefly, and I think Joelle already did.

With regards to security the only thing I will say here is that it is largely a COL applicant responsibility. I think the reason that it is an open item is less technical and more programmatic.

That department of the NRC has been really busy with all of the issues related to security at this time. And the other open issue is they haven't done the review yet, so it is not a technical issue at this time.

The only other thing I will say is that we did provide a report that is the design feaTures of AP1000 requirements. In the revised DBT and the ICM. Southern Nuclear which also is our contractor there,

and they are safeguard agents in that regard, and are more familiar with those kinds of -- they are working with us on that issue.

With regard to the main control room X/Q, I think that -- this is one of those things that is sort of a COL applicant interface issue. But also is related to the design, because how you calculate your control room X/Q is related to certain design features of the plant.

And I think we are working with the Staff to try to understand what is the requirement that should be captured in design certification, or what are the parts of that evaluation that we want to have approved by the Staff as part of a design certification, and what is the true interface.

And so the MET data, for instance, is an interface. And when we do our control room X/Q we take an assumed MET data, or a worse case MET data, but we do have to accurately capture what are the interface requirements there, so that when an applicant can reference the AP1000 he is able to asses those analysis for his site.

But we have performed control room dose calculations with the X/Q that we calculated, that we believe is appropriate for AP1000, based on a limiting

site -- set of site meteorological information.

We looked at several potential candidates for the MET data, and tried to come up with a limiting X/Q dose calculations.

CHAIRMAN KRESS: The Reg Guide discusses wake issues related to the buildings?

MR. GROVER: The Reg Guide is, primarily, guidance on the use of the Argon 96 computer code for -- which is specifically created to calculate the --

CHAIRMAN KRESS: Yes. And just gives you guidance on how to use it?

MR. GROVER: Yes, and limitations on assumptions.

MR. CORLETTI: Recognize, we did this calculation for AP600 in 1996, or '97, long before the Guidance came out. And at that time there was guidance, there was a NUREG. And so we did what we think is a conservative calculation using that.

And we just got the Reg Guide in June, and we are trying to understand -- the conservatisms we used are equivalent to the conservatisms that is in the Reg Guide, and we need to provide that to the Staff to asses this issue.

MEMBER LEITCH: I seem to recall that there were, really, a package of three Reg Guides that

were issued in June. Is there only one that applies to the control room design?

Perhaps I'm mistaken, but --

MR. GROVER: There are three, one was on the assessment issue, one was on Argon 96 guidance. I don't remember the other one.

MR. CORLETTI: On the tracer gas issue, that is probably more appropriate for the COL. So there are certain commitments to do leakage tests in the control room. But the specifics on how you do that assay control --

MR. SEGALA: We do have a COL.

MEMBER SIEBER: But there are ancillary issues associated with that. For example, if you have a control room surrounded by a bunch of other -- all kinds of different BPs, I think that the design in the ventilation system ought to be such that you can provide sufficient assurance that you are always negative in the control room, instead of negative here and positive there.

MR. CORLETTI: This was a tough issue for us on AP600. Our HVAC, or our safety -- for our control room, that we depressurize our control room. And we shut off, I think, the surrounding HVAC system.

So we felt that we have a very good, by

the nature of that design, overpressurizing the control room, we are able to demonstrate that pressure without the tracer gas test.

However, I think that -- unless you agree to do that sort of test for AP600, and we are carrying that for AP1000.

MR. SEGALA: Part of this depends on how tight the control room is when it is actually built, whether gas would allow us to verify that the assumptions are consistent with --

MEMBER SIEBER: Well, the practical problems that you are going to run into is the fact that you usually have cable spreading area, which is why you would like it to be leak tight and separate from the control room.

And then also the process rack room, where your instrumentation and your process equipment is, which requires cooling, external cooling. A lot of switch gear, low voltage switch gear.

And because of the fire restrictions that are in different rooms, with different air conditioning requirements, that is ---

MR. CUMMINS: Yes. The AP1000 and the AP600 design in this area is -- we have four divisions of batteries, and four divisions of INC, we call it

PMS, protection and monitoring system. You will see some of that this afternoon.

And then we have four divisions of whatever electrical switch gear that is required. They are all in the clean auxiliary building, and they are all in separate floors. They are away.

And what we normally do is supply HVAC and cooling to them with a sort of a standard HVAC system that is not safety related. And if we lose power, or lose those systems for some reason, we have analyzed that in a 72 hour period, the heat sink of the building, and the concrete, will maintain the temperatures in the room at acceptable temperatures for the operation of the equipment.

So it is a passive cooling system, and the same applies to the control room ceiling, control room, basically from the ceiling. For the -- so for those switch gear room, and INC rooms, there is no HVAC supplied in that period.

For the control room we still needed to have it pressurized, even though we had no power for some fan. So what we did use is air bottles. We have -- and we pressurized the control with a continuous supply of air from air bottles, for the 72 hours.

And it turns out that after 72 hours the

dose calculations are such that you can open it up after that period, and still have acceptable dose rates for the operators.

MEMBER SIEBER: Well, this is the same design as many of the current generation plants. I guess my -- my only concern is that a lot of licensees are struggling now to try to meet the current regulations, and you are putting forth a design that is very similar, in my opinion. And you are going to struggle, too.

MR. SEGALA: There are a few plants that have bottles, but they don't rely on them for 72 hours. Most of them have one hour.

MEMBER SIEBER: The one down the road here has one hour bottles, and it has a subatmospheric containment, and the idea is the containment is supposed to go subatmospheric and leak in instead of out, at about the same time the bottles are exhausted.

By the way, those bottles are 2,000 pound bottles, and there are six of them, and they are big. And so if you have them for 72 hours --

MR. CORLETTI: We have big bottles.

MEMBER SIEBER: That is a big deal. I mean -- I would expect that number of bottles would be in --

MR. CORLETTI: We can show a drawing of the picture of the bottles. There are 30 some bottles.

MEMBER LEITCH: The experience with the existing -- is that most people are experiencing much higher control room leakage than was originally predicted. And so I guess the admonition here is to make sure you've got enough bottles, or if there is anything that can be done in the design at this stage to consider and minimize control room leakage, that would be of value.

MR. SEGALA: A lot of what the existing plants are facing is they have other ventilation systems that run duct work through the control room, that leak into the control room. They have duct work for the control room ventilation system that goes outside of the envelope, and on the negative side of the fan, that will suck contaminated air in and put it in the control room.

They have poorer construction of the actual boundary of the control room. And there are many factors that affect plants that with the bottle system you don't necessarily have all those mechanisms that the existing plants have.

MR. CUMMINS: Yes, one other comment that

-- the digital control room really eliminates cable spreading room. So the number of cables or wires that come into a digital control room are, I don't know, they are tens. Instead of thousand, they are maybe ten.

MEMBER SIEBER: So you use the data buss like a --

MR. CUMMINS: Exactly.

MEMBER SIEBER: As opposed to individual signal wire?

MR. CUMMINS: Yes.

MR. SEGALA: So the controls are all by sending a signal out a data buss, so it is one wire, it is not really one wire, because there is some redundancy. And there are a few manual controls, and that is where you actually have the wire that can control --

The interface computers aren't in the control room.

MEMBER SIEBER: Let's say you have a piece of fiber, and that goes through the control board, you have to have something in the control board to read that piece of fiber, or metallic --

MR. CUMMINS: Yes.

MEMBER SIEBER: And interpret what that

is, and route it to indicators, control switches, and so forth. There has to be stuff there.

MR. CUMMINS: Yes, I think this afternoon we can see.

MEMBER SIEBER: Yes, I'm looking forward to it, thank you.

MR. CORLETTI: The soon to be revised 10CFR50.44, which essentially allows for some relaxation of the QA on some of the hydrogen recombiners equipment, like the hydrogen -- I think we were expecting this to be approved, I think, last year.

I think it is now slated for approval this year. We've performed our design looking at that. One thing we did maintain our passive hydrogen recombiners response that we had from AP1000, or AP600. The change there is that they are not safety related.

And that is how we've addressed -- that is how we've modified the design to be in compliance with -- or to allow for relaxation. They still provide for defense in depth.

I think it is going to be more of a programmatic as, hopefully, the new regulation can be passed before -- I would like our FSER before the

regulation passes, but we will deal with it.

I think that the nature of this, there may be a technical issue that is -- I'm not sure, I think that is largely the issue.

MR. SEGALA: The staff has, they are still reviewing it, they are looking at mixing inside the containment and stuff, but they haven't finished their technical review.

MEMBER SIEBER: You do provide igniters in the --

MR. CORLETTI: Yes, we do. We have igniters throughout the containment.

MEMBER SIEBER: And I presume you do not provide recombiners?

MR. CORLETTI: We have -- not the active recombiners that you are familiar with, but we have these passive H2 recombiners.

MEMBER SIEBER: Right, okay.

MR. CORLETTI: And maintain those. For defense in depth, also, there is some international applications that would still require, like hydrogen recombiners, and we would like to apply AP1000 in other places besides the United States.

CHAIRMAN KRESS: Are these big enough to do the severe accident hydrogen?

MR. CORLETTI: They are probably not fast enough, is an issue -- but we haven't tried to qualify them for that.

This next slide, that is really the end of my presentation on the open items, and this is just my way of introducing Warren. I just wanted to just make a point that AP1000 is really -- is a passive plant.

But really it is using proven features throughout. And in the materials issue we think with the operating fleet of PWRs, we have excellent leading indicators of materials issues.

And we have been trying to incorporate that knowledge into the design of AP1000. And so being a PWR, and really using proven components, we have the benefit of the operating experience of the fleet of reactors.

And I don't know if you all have the same appreciation for the design of AP1000 in regards to the reactor coolant system, as a lead-in, some of the key features of the reactor vessel, which is no penetrations in the bottom head, the penetration is in the top head.

We have designed for inspectability of those penetrations. The flu piping is made largely of vent pipe, reduced number of valves, with elimination

of the cross-over pipe is a reduction of the welds in the piping.

Steam generators are similar to steam generators that are in operation today. I think we have most closely looked at our reactor steam generator that we provided, and others, to serve as a starting point to the AP1000 delta 125 steam generator.

MEMBER WALLIS: It is a bit of a stretch to say that because it was approved for AP600, it is a proven component.

MR. CORLETTI: No, it is not -- you are absolutely right, if that was the only reason, it wouldn't be. It was really because these components are in operation today.

MEMBER WALLIS: That makes sense.

MR. CORLETTI: Not because it was AP600.

MEMBER WALLIS: Well, I think that is what you need to stress.

MR. CORLETTI: Yes. And I think that is what I'm trying to -- all these components have proven operating experience.

So with that I think, if there is any other questions on reactor coolant system -- yes, John?

MEMBER SIEBER: I would like to jump back to control room reliability for two short questions.

MR. CORLETTI: Sure.

MEMBER SIEBER: Could you tell me what the thickness of the concrete is on the containment?

MR. CORLETTI: On the containment shield building?

MEMBER SIEBER: Yes.

MR. CORLETTI: It is three feet.

MEMBER SIEBER: Three feet. And the control room walls?

MR. CORLETTI: Two feet.

MEMBER SIEBER: Two feet.

MR. CUMMINS: It is a pretty massive structure.

MEMBER SIEBER: And right outside the control room, according to your drawings, you have one of the two main steam lines, right on that opposite wall, right? Big line?

MR. CORLETTI: Yes.

MEMBER SIEBER: With a lot of flow?

MR. CUMMINS: Yes, we were challenged on that by the Staff, in the AP600.

MEMBER SIEBER: And yet you did it again.

MR. CUMMINS: And I think that, I'm not

absolutely certain about this, but we had to define a break, I think it was a one square foot break, and then --

MEMBER SIEBER: It is possible you can get one that small.

MR. CUMMINS: And prove that the wall was fine, and the control room was fine, and we went through that series of discussions.

MEMBER SIEBER: Well, do you have blowout panels, or something like that?

MR. CUMMINS: Yes, we do.

MEMBER SIEBER: As opposed to just blowing up the guys in the control room, of which I used to be one?

MR. CUMMINS: We do have blowout panels. And I would say that -- I'm not sure that we were so interested in protecting the operator as not pressurizing the room to --

(Laughter.)

MEMBER SIEBER: You meet the regulation but unfortunately the operator didn't survive. That answers my question, which actually deal with several issues.

MEMBER FORD: I have a question. Joelle is at least 18 unresolved RAIs, and you addressed

some, and you passed some of them to Warren. What is your feeling as to how quickly some of these unresolved RAIs are going to be resolved?

MR. CORLETTI: Well, of 174 questions, there were probably, of that, about -- there is a number of about 80 or 90 were kind of new items. And 80 were items that actually we knew about, and have already provided the answers in April.

And the Staff, it is understandable, they have to stop accepting new information at some time, and write the issues. But I think since -- when they were done writing, I think they have a response for, say, half of those issues, that they have been evaluating now.

And that is why they have already been able to resolve some 35, I think, quickly. Probably the ones we've already identified we think we gave very responsive answers, so I would expect --

MEMBER FORD: So which is the -- is it the Staff, or with you?

MR. CORLETTI: And the rest of the questions we owe answers, I think, we said in July we provided all but about 20 answers. So I think it is a combination of are our answers good enough, and can we have the Staff read them.

I think we can -- we believe we can resolve these issues in a short time frame. Since there are 40 on ITAAC, there is largely programmatic issues.

I think we had a meeting, and I think almost all of them have been resolved. So the number is big, but I think we can -- we expect to be able to resolve these in the July and August time frame.

MR. CUMMINS: Yes, but Westinghouse has a goal of providing all the answers by the end of July, and then revising the DCD and the PRA by the end of August, that is so that these confirmatory things can be, in fact, confirmed.

And the Staff, understandably, has to look at them, and decide where their resources are. And I think they are in the process, and they can speak of trying to schedule their part, because the ball is going back to them, and their part of the review, to see what they can do with them.

MEMBER FORD: But you heard Dr. Wallis, which I fully agree with, that we need more information from the DCD. So we can have more detail, to some of Warren's concerns, and some of the hydraulic concerns, and things of these nature.

So it will take time for us to understand

what the real problem is, rather than just what the word problem is.

MR. CORLETTI: Yes.

MEMBER FORD: And I'm just trying to work out where the ACRS stands on this, as to how we can be productive, and what we can honestly sign off on.

MR. CUMMINS: I think we have tried to highlight, in the meetings, what we felt were the real issues. The real issues have been thermal-hydraulic issues that we've been dealing with for a while.

Maybe issues on materials, it is a very important issue to us, and when we understood the nature of it, we already had one meeting two weeks ago, and we are probably going to have another, and I think next week, and I think we are making progress.

So that is a technical issue that is important to us.

MR. SEGALA: Part of the thing is, you know, Westinghouse at the end of July is going to respond to all of our open items. The Staff is going through and looking at them, reviewing them, and they are going to do an acceptability review to let us know which ones are okay and which ones aren't.

And just because Westinghouse responds to it in July doesn't mean that it is necessarily

acceptable to the Staff, and we have to go through that, and look at that, and communicate back to Westinghouse what our remaining issues are, and have further meetings, and further discussions to hash them out.

I think the more we articulate and communicate, the quicker we can get this stuff resolved. But, again, we have to reassess our schedule, get feedback from the Staff, after they have looked at all these responses to see how far out is this going to take us, to resolve these issues.

MR. CORLETTI: And there is, you know, as Joelle said there -- and liquid entrainment is one issue, and it is hard to resolve that issue -- we would probably quit.

(Laughter.)

MEMBER RANSOM: It is getting easier. Could you explain your second sub-bullet, under your first bullet, to me? The first bullet.

MR. CORLETTI: Yes. We have -- our core design is a 14 foot, 157 pool assembly -- those two reactors have the same --

MEMBER RANSOM: Oh, those are reactors?

MR. CORLETTI: Those are operating --

MEMBER RANSOM: Now I understand.

(Everyone speaks at the same time.)

MR. CORLETTI: I mean, you are right, 193. So, you are right, it is 14 foot fuel --

MEMBER SIEBER: I just wondered if you --

MR. CORLETTI: No, we are proud of Texas.

CHAIRMAN KRESS: In the configuration not only is the core the same, but the internals are about the same, it is not exactly the same. The issues with internals are similar.

MEMBER SIEBER: The AP600 is 12 foot fuel?

MR. CORLETTI: Twelve foot fuel --

MEMBER SIEBER: Like your current plant?

MR. CORLETTI: You are right. And essentially AP600 had 1,000 megawatt reactor, and we had derated it to a 600 megawatt. And we had a few less assemblies to allow for that radial reflector.

When we went to AP1000 we took more of a standard design.

MEMBER SIEBER: Except that it is a little longer than your 1970s vintage plant?

MR. CORLETTI: Slightly longer than the -- to allow, we have a little more gas space in the --

MEMBER SIEBER: They have the same numbers of grids as the 12 foot, or did you add an extra grid? I'm sure you added an extra grid, at least one, I

would imagine.

CHAIRMAN KRESS: Okay. Is this the time for a break now?

MEMBER SIEBER: Yes, it is.

CHAIRMAN KRESS: Before we do that I have been reminded that we have a public citizen here that may want to make some comments, is that right? You may want to introduce yourself.

MS. STARRET: My name is Susan Starret, I'm a professor of philosophy at Duke University. And I think most of you have heard me speak before. Prior to my academic career I worked in the nuclear power industry, including on the AP600 for Ron Vijuk.

The topic I'm going to bring up today is the same as the one last time, it is just that I'm going to tie it, show how it relates to -- do I need to speak louder? Show how it relates to the open items.

If you remember that the question I asked, when I spoke earlier this year to the ACRS, was about the level of design completeness in the systems design. That is, is it a conceptual design of the system capabilities, or is it a final design.

The process of -- this process of going from a completed design, the AP600 to the AP1000, I

think can -- makes it especially difficult to tell, because there is lots of detail there that is inherited from the AP600.

So do you know, you know, was that pipe size designed with that valve design, or is it there because it was there for the AP600 and we just didn't change it, and maybe it needs to be changed, and maybe it doesn't.

So that is the question. And I was especially talking about fluid systems designs, the flow temperature and pressure in the systems.

Now, in the 10CFR52 process, as I understand it, the level of design is to be the same of the DCD submittal, is to be the same level of detail as under the old system, the point in time where an operating license was being applied for.

So that means, basically, the fluid systems design should be done insofar as this is possible. Now, this was a concern that cut across many systems, and so my concern was kind of amorphous at the time, trying to make it a little more specific, and tie it into the open items.

So to make it a little more specific, many of the statements that are making in the DCD are about the capabilities of systems. And so when I looked for

an example, I just pulled out one of your DSER section, section 10, on the main steam system.

I didn't have time to go through all of them. But that was the one I used an example from, the last time I spoke to you. So the review looks like what gets done is, they look at what the claims are for the system capabilities made in the DCD, and then compare them to the standard review plan criteria and say, yes, this meets the criteria.

So my question is, that is fine, but the further question I have is, what -- are you asking the question have the systems been designed, have the design details been done.

So the example I gave last time, just as an example, and it wasn't that I had any reason to have a specific concern, but I just said, for example, the main steam system, one of the changes, whenever you do an upgrade is -- upgrading, usually is that the steam pressure changes.

And so you check things like, okay, that is the driving force for things like the relief valves, and any other lines that use the main steam system pressure.

So I would -- I think that when you do an upgrading you actually check and see, okay, these are

the things that should have changed, or have to be looked at, you have to do new calcs for that, did you do that.

I'm not sure whether those kinds of questions are getting asked. And the approach that you are taking here, where you are taking the standard review plan, you are looking at the claims that are made for the capabilities of the system.

That is the question I have. I honestly don't know the answer, I'm just raising it. Maybe an analogy here is something that was talked about earlier, say, an analogy in the structural arena would be the level of detail for the containment structural design.

For instance, there was a statement in the DCD that the containment meets the ASME code, then when the Staff asks, is the analysis done, the answer was, we thought that was a COL item, as I understand the documents I've read.

And then the NRC's response is no, you really have to do that now, and that is the kind of question, point, I have here. It is just that it is in fluid systems design arena, rather than the structural.

So the next -- I think the response that

was given the last time I brought this up was, well, is this really related to safety analysis, because it looks like for the primary systems, for the primary passive systems, we really do look at the flows and stuff.

Well, I think that a lot of the auxiliary systems, I think it is -- it should be part of the review, because you are approving this design, you want the main steam system to be able to do what it claims it can do.

Some of them might come up in RTNSS, but again, I wonder if the RTNSS review isn't something like the standard review plan review, where you say, well okay, here is what the system is -- the important system is supposed to do. Good, it does it, and therefore the RTNSS review is okay.

Again, the question I'm asking has to do with the claim about what the system capability is, versus whether the design detail is done.

Now, how does this tie into the open items? Well, one open item it relates to is the one about the QA process. That was on slide 7 of Joelle's presentation, where inspection of the implementation of the project specific quality plan at Westinghouse.

So I will just explain why I think it is

related to that open item, and how. The QA process for the AP1000 can't be exactly like the AP600. For example, there have been some organizational changes. I don't know what they all are, but one that has to be different is that the Advanced Reactor Corporation is not involved any more, and they provided some sort of role in guidance, or review, or whatever.

They were involved in every design change. For people that don't know about the AP600, the Advanced Reactor Corporation included people from all different utilities. So you had this involvement of utilities.

Now, why is that important? Well, because I think that how the AP600 information is used, and is partly dependent on -- well, it is going to have to be covered in this process.

And the question of who gets to decide whether a change needs to be made or not, from the AP600, well I think that that is important. I mean, is it at the level of people who are just involved in projects, and they say, these are the things that we've identified, we have to change, so let's go make those design changes.

What is the process? I really don't know what the process is. But one thing you might think is

natural is to say, well, when the engineers who signed off all these AP600 reports and designs, did they -- are they part of the process in making this change from the AP600 to the AP1000, did they get to say, okay, yes I agree that the AP600 design fits for the AP1000?

I really don't know what the process is, but I can't -- I don't think it makes sense to say that we are going to use the same as the AP600, because it seems to me new kinds of questions arise.

I think that is all I have to say.

CHAIRMAN KRESS: Does anybody want to respond? It seems like a question to the Staff.

JOE: We have no comments at this time, I think.

MS. STARRETT: Okay.

MS. STAREFOS: I think on behalf of the Staff, we have had some stakeholder interface on certain issues, and we intend to try to address the concerns, and we plan to do that in a public forum.

MS. STARRETT: Okay.

MS. STAREFOS: And possibly a letter of some sort.

CHAIRMAN KRESS: When will this public forum be?

MS. STAREFOS: A letter, a publicly available letter to respond to some of these issues.

MEMBER WALLIS: Will the letter give specific examples, or just generalities?

JOE: I think she has a general overall concern, and she is giving specific examples to try to point out what her overall concern is. So I think we are going to try to address the overall concern.

MEMBER WALLIS: But not make specific examples?

MEMBER SIEBER: Well, I don't think these examples are totally accurate, but the concern is still there. For example, steam pressure in the main steam system is a function of what P average is.

I said the specific examples don't exactly fit, when you upgrade, or up the power of reactor, the steam pressure is a function of T average. And what goes up is steam flow, so you have to size the line to accommodate the flow.

Relief valve setpoints don't change, but relieving capacity must change, because you have more stored heat.

MR. CORLETTI: Sure.

MEMBER SIEBER: So even though we might not be totally accurate in the way it is presented,

the point is that you have to consider all these things, as you go through the design process for the auxiliary systems.

And so from that standpoint I accept and understand the --

MS. STARRETT: Okay, fine. The question is a question about level of detail. In other words, you can easily size a valve, and then you say, well, what about the actual layout of the line, do I get the flow I need.

MEMBER SIEBER: Thank you.

CHAIRMAN KRESS: Okay, I guess now would be a good time for a break.

(Whereupon, the above-entitled matter went off the record at 10:07 a.m. and went back on the record at 10:30 a.m.)

CHAIRMAN KRESS: Let's come back to order now. At this time, Warren, you are up.

MR. BAMFORD: We are going to pick up the presentations again. My name is Warren Bamford, I'm a consulting engineer here at Westinghouse, and I deal with cracks, and almost everything.

I was involved in leak report break in the original presentations to you folks back in 1983 and '84, when we --

CHAIRMAN KRESS: I don't remember that.

MR. BAMFORD: -- concept of --

CHAIRMAN KRESS: I don't remember that.

MR. BAMFORD: Well, I'm not going to go over it right now.

So what we are going to talk about today is leak-before break issues, relative to AP1000. The concept that we are using in AP1000 is to use the same -- is to use the piping design acceptance criteria, instead of a set of detailed piping design and analysis calculations.

It is the same approach that was already used in ABWR, and also the system 80+. The AP1000 piping configurations are pretty similar to the AP600 configurations. The routings of the lines are the same, the piping size in some cases have changed.

MEMBER WALLIS: Which pipes are you talking about?

MR. BAMFORD: I'm sorry?

MEMBER WALLIS: Which pipes are you talking about? You are not talking about the main pipes in the RCS? Do we get to find out, later on, which pipes these are?

MR. CUMMINS: We are talking about the main pipes of the RCS.

MR. BAMFORD: Well, what we are going to talk about, the final design and analysis design is completed during the COL stage, but we are going to talk about the concept of licensing leak-before break for the design because there are some important aspects of leak-before break that will have impact on the design.

So we are working through the design aspects with the assumption that the piping systems will be qualified to leak-before break, but the final analyses will be confirmed during the COL stage, and the final piping design and analysis is verified by the ITAAC during construction, as I think you might have heard before.

There are two items that I'm going to talk about, that have been identified relative to leak-before break, and the numbers are shown there. I will try to explain what they are. They are really closely related.

They are related to stress due to cracking, and there is a very long bullet here that explains what this is. But what we are being asked to do is to include, in the combined operating license applicant commitment, to implement certain inspection plans, evaluation criteria, and other measures that

are imposed, or adopted by operating PWRs with currently approved leak-before break applications.

We have incorporated the combined operating license item in the AP1000 DCD as part of the commitment to complete the leak-before break evaluations.

MEMBER FORD: Warren, could you just expand on that last bullet, the last sub-bullet? As our conversation goes on, through your presentation, it could well be that there will be other degradation modes that need to be taken into account, which may well need experimentation to resolve.

MR. BAMFORD: Right. And that is the --

MEMBER FORD: How does --

MR. BAMFORD: -- we are having it as a COL item, because there not only may be other things like that, that come along, but there may be other operating plant experiences that come along, that we need to take account of before we actually license one of these.

And that is the reason for having some of the actions done now, and some of the actions done at the time of commercial operation.

MEMBER FORD: Even tough that might impact on safety, rather than availability?

MR. BAMFORD: I'm not entirely sure what you mean.

MEMBER FORD: If it is just a leakage question then that, presumably, would affect availability rather than safety. If it affects rupture of the pipe, then that would be safety.

MR. BAMFORD: Right.

MEMBER FORD: And is it appropriate, if you have that situation, that it would be put off to the COL? Should it not be attacked up front? Of course that is a question which I'm not too sure --

MR. BAMFORD: I will give you my opinion. Putting it off to the COL would make sure that any issues that come along, between now and then, could be addressed before the plant would be licensed.

So I think that it is probably an advantage to put it off. Now, we are covering all of the issues that we believe exist right now. But we know, from the experience of the last two or three years in our operating plants, we have had some surprises.

And the purpose of making sure, the purpose of postponing, dealing with this in a final way through the COL, is to make sure that any surprises that come about, between now and then, we

can deal with.

So we are trying to deal with everything we know about, right now. And then anything that will come along in the meantime, between now and 8 or 10 years, or whenever we would license one of these, we should be able to deal with at that time.

MEMBER SIEBER: Let me ask the question, the leak-before break for the reactor coolant system applies to the current generation of operating reactors.

But some of the elements have measured leakage, and there is --

(Phone interruption.)

MEMBER SIEBER: Let me continue on with my question as we rearrange the furniture.

There is a -- oops.

(Phone interruption.)

MEMBER SIEBER: There is a standard way, in a Westinghouse PWR, and other ones, to measure RCS leakage, that is basically a water balance technique, and you can look for other things.

If the way AP1000 operators are to measure RCS leakages is the same as the current method, then you can tell me that. If it is something new, or more exotic, I would like to know what it is.

MR. CUMMINS: The first way to measure RCS leakage is pressurizer mass balance. It is just traditional. I would say that in the AP1000 it is easier to do a pressurizer mass balance, because we don't have seal injections, and we don't have letdown.

So there is less variables in the equation. After that our criteria for measuring leakage is .5 GPM in an hour. We want to be able to measure a leak of .5GPM in an hour.

MEMBER SIEBER: What would be the uncertainty associated with that, do you know?

MR. CUMMINS: I think that we multiply and you can tell me here, we multiply it by ten, right? That is in his equation he assumes a safety factor of 10 for leakage.

So we have a very sensitive sump monitor, and we have been careful to direct all of the drains, etcetera, to the sump. So that is, probably, our primary way to see a leakage.

And we also have, because of the -- really the redundancy, or the diversity requirements for the Staff, we have a sensitive radiation detector which is supposed to be able to measure leakage, or increases in leakage of that order of magnitude. So there are three ways.

MEMBER SIEBER: The secondary measurement, which is radiation, another one is humidity, and there is -- you look at a couple of different kinds of radiation. There are also standard procedures.

I never really preferred measuring sump level, because you have cooling water systems in there, inside containment, which typically condense moisture out of the containment environment, drip on the floor, run to the sump, and it is usually far greater than a leakage out of the reactor coolant system.

So that masks the true measure of leakage. Now, I take it, that you can just measure changes in pressurizer level, and you don't need integrators on let down, and seal injection, and leakoff, and that kinds of stuff.

MR. CUMMINS: There is always some little analysis of temperature changes --

MEMBER SIEBER: Yes, that goes along with it. But that is the only measurement that you have to make, other than temperature and pressure?

MR. CUMMINS: Yes.

MEMBER SIEBER: Okay. That answers my question, thank you.

MR. BAMFORD: All right, let me go on

here. The second open item was a related item, and it was the NRC that has requested that we do some sensitivity studies to address uncertainties related to PWSCC, and its impact.

Specifically they suggested that we, in the way we make the leak rate calculations, that we look at a possible model of crack morphology based on TGSCC as an example.

The reason that they suggested this is that we are unable to crack alloy 690, or 152, or 52, so we don't have any cracks that are typical of stress corrosion cracks.

So they have suggested that we use a typical TGSCC crack in stainless steel, as a model for that. And we are evaluating whether that would make a good surrogate or not. And we are still having some discussions with them about how to make those calculations.

The net impact of such a thing is that the more rough that the crack surface is, the less crack, the less leakage you can get out of it for a different crack size.

So we have had some discussions about that, and I will try to go over some of the details of that, in the next few slides.

We had a meeting with the NRC last Friday, and I think we had some good discussions. We each had some ideas about how to resolve these issues. We had some follow-up discussions at our plant, and I am going to try to discuss what the issues are, here, and talk a little bit about some of the ideas that we have for resolving them.

And my presentation is probably 15 minutes, or thereabouts, plus however many questions you may have.

MEMBER WALLIS: When materials people work on cracks, and they tell us something about morphology of cracks, and all this stuff, and I have not yet seen any capability, in the agency, to predict the leak rate through these tortuous cracks.

And so it is possible that you could get cracks which are actually much bigger than you think, without much leakage.

MR. BAMFORD: Well, there are -- Westinghouse has an internal program that we have developed, that is based on a lot of experimental data, and also there is a program that has been written, which I believe was written by the NRC, called PISEP, that does the same sort of thing.

So there are programs around that are

useful to make such predictions. They have been benchmarked against --

MEMBER WALLIS: It would depend, a lot, on the morphology of the crack, all these materials crack differently, and you get these things which are all very sort of wiggly, squiggly, and have all kinds of branches going everywhere.

MR. BAMFORD: That is right, and the more of that stuff you have, then the more tortuous the path is for the leakage. And so --

MEMBER WALLIS: But you could have a material which is sort of riddled with cracks, and is about to fail, but it doesn't leak very much.

MR. BAMFORD: Well, it is important to mention that the materials that we have in the AP1000 are all very ductile, stainless steel, and the alloy 690, and 182 materials are all extremely ductile to fracture.

The material is so tough that it really is very difficult to even fail it. It fails -- it is not even sensitive to the presence of a crack. It fails in the same manner as if it would fail if there was a notch.

So the fact that you have a sharp crack doesn't seem to even affect these materials. So they

are very, very high pressure tolerance. And these materials, and they were chosen just for that reason.

So the materials that we have in the present plants, are alloy 600, and alloy 82 and 182, which are all known to be sensitive or susceptible to stress corrosion cracking.

And because of that we have decided not to use those materials in AP1000, and also AP600. And what we have gone through is alloy 690, and 52, and 152, which are -- I will describe in a little bit the differences.

But they basically have been shown, by a number of years of testing, and research, to be not susceptible to stress corrosion cracking.

However, the recent cracking experience in alloy 600, and 182 and 82, has peaked the NRC's concern about these type materials, and whether we know enough about the new materials that we have adopted, to be sure that they won't crack in service.

And so that is what I want to talk about here, is what we know, and how we are going to try to resolve that concern. But the cracking that has happened in operating plants really isn't directly relevant to the AP1000.

However, it does bring up the question,

well how much do we know about the new materials. A historical perspective on 690 was put together for me by Bob Fuld, who is sitting right over there, and he is going to answer any hard questions that I get.

But the history of Alloy 690 was that it was adopted as a steam generator tube material, or replacement material, as far back as 1986. The first alloy 690 thermally treated material began service as steam generator tube flux around that same time.

Since the initial replacement steam generator startup at DC Cook, in May of '89, alloy 690 has been in service, and it is now in service at more than 50 PWRs, and the number is growing, as more plants replace their steam generators.

Applications of 690 have been expanded to extend to steam generator divider plates, pressurizer heater sleeve penetrations, the heater sleeve penetrations, and the combustion engineering design, and B&W designs are alloy 600, and they are being replaced with alloy 690, so that is another place where they are showing up.

They are also being -- alloy 690 is also being used as a replacement for CRDM tubes in replacement reactor vessel heads, that I'm sure you are aware of now, and also small bore instrument

penetrations have -- are being replaced with 690.

MEMBER SIEBER: Let me ask a quick question. When you talking about steam generators divider plates, are you talking about tube support plates, or the divider plate in the channel head, or the wrapper, or what?

MR. BAMFORD: The divider in the channel head. The newer designs have alloy 690 solid divider plates now.

MEMBER SIEBER: Thank you.

MR. BAMFORD: Several of the CE designs that have been repaired with 690 have been in service since around 1989. So we have about 14 years of operating experience at temperatures exceeding 620 degrees and nearly 16 years in pressurizer penetration applications.

So we really -- we do have a fairly extensive operating history with the alloy 690 base metal. However, alloy 690 base metal is not really used in the primary loop of the AP1000, or the AP600.

What we have is the equivalent weld, which is alloy 52 and 152. They have a shorter period of service, experience, in those materials. And the next couple of slides are mainly intended to identify how long these have been in service.

MEMBER FORD: Warren, a clarification. You said 690 -- that 152 and 52 are?

MR. BAMFORD: In the piping systems -- the place where we are using the anconeal materials is in the safe end regions.

MEMBER FORD: So the piping could be, what, 316L?

MR. BAMFORD: It is 304 or 316, stainless steel.

MEMBER FORD: With 52, 152 welds?

MR. BAMFORD: And those welds would be the welds between the pyritic vessels and the stainless piping.

MEMBER SIEBER: The main piping --

MR. BAMFORD: No, it is forged. The reason for that is to avoid thermal issues that we have had before.

So alloy 52 and 152 are welds that are going to be used in the primary piping system, where the system meets ferritic components like the reactor vessel, for example.

And 52 and 152 have been used for a long time as well, but not as long as the base metal, 690. And you can see here, from the slide, that they have been pretty widely deployed, and the material, the

chemistry is pretty similar to the chemistry of 690, so we expect the same level of corrosion resistance that we see at 690.

The earliest application was in combustion engineering design pressurizers with partial penetration welds in the repairs that were made in the bottom head of pressurizers.

We also have alloy 52 and 152 welds in some steam generator replacements. The first of those were in North Anna 1, and DC Summer. They went into service in around 1993.

So we've got nine and a half to ten years of service, basically, with alloy 52 and 152 in PWRs.

MEMBER FORD: They are all relatively small, is that correct?

MR. BAMFORD: I would say, in general that is true, yes.

MR. FULD: Usually partial penetration as opposed to your large --

MEMBER FORD: Coming on to it, I think you were talking about North Anna, and repair welds, which there was crack, so that is why I bring --

MR. FULD: You mean the CRDM?

MEMBER FORD: Correct.

MR. BAMFORD: Yes, the biggest

application, I guess, or the biggest case that I can think of, where alloy 52 is being used is in the repair that was done for VC Summer on their outlet nozzle pipe weld, a couple of years ago.

What we have seen so far, in the field, as well as in the lab, is that we are not able to crack these materials. However, the materials have not been used for a long time frame. So you could ask yourself, well, does that mean it is going to crack in another two years, or does that mean it is never going to crack?

Well, you know, a comparison could be made to alloy 600. When Alloy 600 went into service in steam generators, cracking was found somewhere in the three to four year period after it first went into service.

So we have 15 years of service with 690,a nd no cracking. So we know that we are a lot better, and we think, the metallurgists among us think that we are in great shape, but you never know for sure. And so that is really the crux of the issue that we have been discussing with the NRC, is that how do you ensure that we don't use a material that might crack some years down the line.

MEMBER FORD: Maybe I'm jumping onto what

you will cover later on, but since you talked about 52 and 152, could you say something about their weldability, ease of weldability?

MR. BAMFORD: Well, we know that the weldability of 52 and 152 is not as good as it is for 82 and 182. And some of the cases where we have had big repairs that have been made, the exposed surface has been -- I will talk about the VC Summer repair, for example.

The exposed surface to the water was 52 material, but the bulk of the weld was filled with 192, either 82 or 182, I'm not sure. It was probably 82, the automatic weld equivalent.

The bulk of the weld was filled with 82. And the reason for that was that impurity buildup, when you are welding 52 and 152, and you can end up with cracking that will not allow you to meet the code acceptance criteria. So there is some work that needs to be done there.

And work is going on in that area.

MEMBER FORD: But what I'm hearing you say is that for large structural nozzle welds the experience base is not very high for 52 or 152?

MR. BAMFORD: As I said, up until now that is true, yes.

MEMBER FORD: And we know that those two alloys are prone to hot shorting, and -- not easy to weld.

MR. FULD: We ran into quite a learning curve with both in Pensacola and -- with the use of the 52, even for a -- to the point where, for example, when Sema replaced the spanish units, they used 82/180. They just wanted to avoid the issue.

They wouldn't do that today, and they have had to fight their way through that problem. So INCO, as you may know, has done some modificational chemistry. So there is a 52M which, ostensibly, was supposed to eliminate these floaters, and things like that, that contribute to the problems with the welding.

And they had to do a lot more activity in grinding, as they make these things. I think right now the technology, and in terms of the application of the technology, I think is a lot better than what it was.

But you are right, we don't have a lot of heavy section weld --

MEMBER FORD: -- provide a quality assurance/quality control aspect during the initial fabrication. Is this a topic that is high on the hit

list of things that the Staff are looking at?

MR. BAMFORD: I think it is not a serious issue, because it is not like we are going to put things in service that have a lot of cracks in them, because the inspections that are required for all of these are much more intense than they ever were before.

And one of the reasons we know about the cracking that we see in 152 and 52, is because the repairs didn't pass the inspection requirements. So I think it is something that we need to be -- it is a manufacturing issue, an issue that we need to be watching.

But it is not an issue where we are going to have a lot of degraded wells that are going to go into service, because we have inspection requirements.

MEMBER FORD: Is this an item that is on the Staff's evaluation list of things?

MS. STAREFOS: Let's ask Joe Sebrosky.

MEMBER FORD: I guess Joe is not there.

MR. SEBROSKY: Yes, this is Joe Sebrosky, I'm a little away from the phone.

MR. BAMFORD: Well, let me explain what we were just discussing. Peter Ford just asked the question about weldability of 51 and 152. And the

question that he raised, and he can correct me, is there a concern at NRC about, or is this an issue that the NRC is paying attention to.

He asked, since we know that 52 and 152 is known for the ability to easily produce high cracks, and also impurities that can create problems with the weld, as they build up, is that a concern?

And I said that it is not a big concern to me because it is something that would be found by inspections that are regularly required, during fabrication, as well as during operation.

And then Peter asked, well, is that a concern that the NRC has. So it is you.

MR. ELLIOTT: This is Barry Elliott at NRC headquarters. We are having difficulty of welding (inaudible).

MR. BAMFORD: You mean 52?

MR. ELLIOTT: For 52. We had -- the ASME code has a code on the welding of this material, and we have endorsed that code case. Nothing else, as far as the NRC Staff, has approved its use.

MS. STAREFOS: Thank you, Barry.

MR. BAMFORD: Okay, let me continue. So what I was telling you is that we really have a lot of information available on the stress cracking

resistance of 52 and 152.

And we expect that laboratory testing will continue during the time between the time that the AP1000 is licensed, and when it goes into operation. So we will have even more experience by the time the plant goes into operation.

One of the things I wanted to mention, the second bullet here, is that even specimens that we pre-cracked and fatigued, that have sharp cracks, have been shown not to propagate.

And we put a lot of the information and details of these tests in the revision of our response to RAI 251.004. So that is where to find more details about that.

We talked about the repairs that have been done to our reactor vessel nozzles, both at VC Summers, and similar repairs are going on at Ringhals, although they are being repaired with an overlay, rather than a replacement of the butt weld, at Ringhals.

We also used an overlay technique for a repair of the CRDM tube degradation at North Anna unit 1, and that was approved in -- I don't think it is 2002, not 1992, that is a correction.

And that repair, which we called the

imbedded flow repair, was generically approved in July of this year, just recently.

And so, in conclusion, we feel that these materials show excellent resistance to PWSCC, both in lab and field experience. But we recognize the reservations that the NRC has about this, because we haven't had 40 years of field experience with this material yet, or these materials.

We will get more lab and field experience between now and the time the plant will be licensed. And we feel confident that we still, that this experience will validate our decision to use the material, and will have, probably, a total of 20 years experience, at least, by that time.

So that is another reason why we put this issue as a COL issue. So it will be looked at, again, before the plant actually -- before the first plant goes into operation.

MEMBER FORD: Before you go on, Warren, could I bring up a question that arose earlier this week? You are going for the high chromium nickel based alloys because of their admitted increase in stress corrosion cracking resistance in the primary side.

However, those particular types of alloys

can exhibit embrittlement at lower temperatures, after they have been exposed to hydrogenated water. During an accident scenario you could have large amounts of cold water coming from the CMT tanks.

Which, conceivably, could give rise to thermal shock at these large alloy 52, 152 welds. Therefore, what is the probability of those welds just shearing off because of thermal shock, if the nozzles get down to temperatures of below about 150?

Now, the phenomena has been known for a long time. The question is, is it applicable to this particular system? You are shoving in lots of cold water, during an accident scenario, lots of cold water. Could you get shearing off because of the decrease in K1C, because of prior exposure to hydrogenated water?

MR. BAMFORD: I think you have a good question, there, Peter. We have, we know that these materials have much reduced pressure toughness, and that it occurs when we have the material exposed to a low temperature with a hydrogen overpressure.

So in order to answer the question we have to look at what the hydrogen pressure levels are during an accident. And I'm not prepared to answer that question right now, but I think you have a good

question, and we should pursue that.

The question actually also applies to operating plants, because the alloy 182 and 82 materials have the same issues. And during a safety injection event the same thing could happen there.

So it is not just an AP1000 issue. But you do have a good question, and I think we should just take the action to answer that. I don't think we should answer it right now, we have to look into it.

MEMBER FORD: The reason why I'm trying to single out the AP1000, as opposed to the other operating plants, and I don't know the thermal-hydraulic are not issues enough to know if I'm right or not.

But these two alloys, 52 and 152, do have very high chrome contents. And if I'm right, more than 182, is that correct?

MR. FULD: Yes.

MEMBER FORD: So they do have a higher chrome content, and in AP1000 the unique feature is you have large amounts of cool water impacting into lines which were hot legs, or the ADS lines, which were prior exposed to high temperatures --

MR. BAMFORD: And my sense is that it is not a problem, but I don't want to slough it off

without looking into it. And I really think we should look into it.

The fact that you might have a reduced fracture toughness in the material doesn't necessarily mean that is a problem, either. Because the issue occurs for the time period that the pipe or the material would be cold, that time frame could be fairly short.

You would have to have a flaw in the material at the same time, and the likelihood of all those things happening is probably not very high, but it is still something we should look for.

MEMBER FORD: Well, my next question --

MR. SCHULZ: This doesn't mean a whole lot, but I think your perception that AP1000 and AP600 are unique in their ability to inject cold water at high pressure is not true.

Almost every operating plant has high pressure safety injection pumps, if they are turned on by the same kind of signal, to turn on the core makeup tank, you will get cold water in the injection lines.

(Everyone speaks at the same time.)

MEMBER FORD: And I excuse myself, by a lack of knowledge in the thermal-hydraulics. But it is a fact that we have high chrome content nickel-

based alloys, two of the ones that we are talking about here, 52 and 152, known to be hard to weld.

Therefore you could have a preexisting crack in the surface, which may have missed the inspection procedure. So that is my question. A question that comes out of it, that thought process, is that fed into the thermal-hydraulics community, and is that then fed into the PRA community?

MR. BAMFORD: We'll take that under advisement.

MR. CORLETTI: Is the design information that these welds will have design transients, is that fed into -- is that the question?

MEMBER FORD: Yes.

MR. CORLETTI: Yes, we do. I mean, we do identify our design transient.

MEMBER FORD: So you do have, in your thermal-hydraulics codes, temperature variations --

MR. CORLETTI: Yes, and we do have an evaluation.

MEMBER FORD: Well, my next question is, is that information fed up to the materials community and say, is this a problem? I'm not hearing a crisp answer yes. But I'm hearing more of an answer no.

MR. BAMFORD: Well, I think the answer is

that we will look into that, because I don't think that we have all the right people to answer that question here right now.

But I think you have a good question, and it is not just a question for AP1000, I think it is for every plant.

MEMBER SIEBER: Is there a difference in chemistry between 52 and 152?

MR. FULD: Yes.

MEMBER SIEBER: What is it?

MR. FULD: The chromium concentrations are almost identical. Ferrite is a little bit lower, and I believe it is the silica --

MEMBER SIEBER: And that is what gives the difference in weld characteristics?

MR. FULD: Well, 52 and 152 are pretty similar, different than 82, 182. In 82 you have about four percent chromium, higher than 182. Both of those, even those weld.

Every time we do an inspection we take weld samples, we find there are residual hot cracks in those materials, as well. These chromium nickel based don't weld like stainless. We can't throw a little ferrite in there.

So we haven't done -- we have never seen,

the only thing I can say unambiguously, we have never clearly seen a relationship between existence of a hot crack, and the initiation or propagation of PWSCC.

Peter's question is somewhat differently directed. It posits that you may have what amounts to a flaw, which has a structural weakness associated with it, and all of a sudden there is this huge thermal shock.

And the associated material can't accommodate the plastic flow, and you get kind of a failure. I talked to Bill, somewhat, about that. And I can't reproduce the -- Bill Mills is in Venice, and has done probably 80 percent of the work in this particular phenomena.

And I can't recall -- I can't reproduce, here, his arguments. But I don't think that they are substantial concern for this. But I think Peter -- Warren is right. I think we can summarize that, and try to work with the T&H guys, to try to put a boundary analysis on --

MR. BAMFORD: There is an EPRI program that is under way to look at this, as well, for all plants, if you are not aware of it.

Let me try to summarize where I am here. We feel that 52 and 152 have excellent resistance. We

recognize the reservations the NRC has. We are still confident that the materials are good ones.

The AP1000 LBB systems are the same as those designed for the AP600. As I mentioned earlier, some of the line sizes have increased, some are actually the same size. The line routings are the same.

The stress analyses that are completed for AP600 demonstrate the feasibility that the AP1000 piping systems can be designed to meet the bounding analysis curve that have the leak-before break margins built into them.

These are the lines that are designed for LBB in the AP1000. Presented here for completeness. One of the things that the NRC asked us was, well, how close are these lines to being exactly the same. And this is one of the examples that we showed them last week.

This is the IRWST injection DVI line, and you can see here that the AP600 is up at the top, and the AP1000 is at the bottom. And you can see that in some of the lines the sizes increase.

Like the one line here is -- went from 6 to 10. This one line to the reactor vessel stayed at 8 inches. So there are some changes, but you can look

at the two designs and you can see that they are very, very similar.

And this is just an example to show you how similar the line layouts are. The leak-before break analysis is done for the AP1000 by developing a set of bounding analysis curves that are based on the pipe material, the pipe size.

And they build in the required leak-before break margins, which are shown here, margin of 10 on leak detection, 2 on flow size, and a margin of 1 on load, using absolute summation of the loads combinations.

The bounding analysis methods are detailed in the DCD appendix 3B, and these methods and criteria were reviewed by the Staff in great detail, at a meeting here in Pittsburgh September a year ago.

MEMBER WALLIS: A margin of 10 on a leak means you are ten times as accurate as you need to be?

MR. BAMFORD: No, the idea is, the concept -- a simple view to me, of leak-before break is, that if you have a piping system, you have a leak, you can find the leak before you get a break.

And then the question is, what margins do you need to impose. Well, when we do the leak-before break evaluations, instead of using the size flaw that

would yield on GPM, for example, we would use the size flaw that would yield 10 GPM.

And then we would compare that flaw size with the failure flaw size. So that is the way the margin would come in, in that particular case.

MEMBER SIEBER: The margin of 1, the bullet there, that looks to me like the absolute value of the sum of frequencies in the seismic analysis. Is that what that refers to? That is, in my view, that is sort of artificial.

On the other hand there was a case where the agency determined that summing the absolute values was the way that they chose to correctly interpret it, which is conservative, that is the conservative way to do that. Thank you.

MR. BAMFORD: To resolve the issue about stress corrosion cracking we have proposed to complete a preliminary typing stress analysis for NRC review, indicate some of the details of that to the NRC last week, to the Staff.

We picked this one DVI-A piping analysis. And if you want me to tell you what that means, I can't tell you, but one of these guys can. But that particular line, or system, was selected based on the experience with the AP600.

It was one of the more difficult lines to qualify, so we thought, well, that might be a good line to use as a conservative example. It is a complicated piping system, it has cases where some of the piping sizes were changed.

It also contains the smallest pipe size that was qualified for LBB. And it has some subcompartment pressurization impacts if the line would not meet the LBB criteria.

So that was another reason for choosing that.

MR. CARUSO: I'm just curious about that. Does that mean you are using leak-before break to eliminate a number of subcompartment pressurization analysis requirements in the containment?

MR. CORLETTI: Yes.

MR. CARUSO: Where else do you use that, what sort of piping -- do you do that for the large bore piping, the really large bore piping tubes?

MR. CORLETTI: To the piping system that we identified as the LBB candidate system.

MR. CARUSO: So you don't do subcompartment analysis for reactor --

MR. CORLETTI: We do for the biggest pipe that is in that loop that is not qualified for leak-

before break.

MR. CUMMINS: I think this is standard practice. We can ask the Staff, but this is standard practice.

MR. CORLETTI: So, for instance, the subcompartment that has a four inch line does not qualify for leak-before break, and so we calculate the pressurization from that pipe.

MR. BAMFORD: This is an example of the results. There are a number of different cases, different pipe sizes, and whatever. But I just chose this one at random to show you what the results look like.

What we have here is this bounding curve. What we are looking at is the maximum stress here, versus the normal stress. What we are looking at here is this curve incorporates the margins that are required for leak-before break on leak rate, flaw size and stress.

And if we plot the stress results for the piping system on this curve, and they are below this line, or on this line, then the system qualifies for leak-before break.

So you can see, in this particular case, there wasn't any issue. The analyses that we are

dealing with, right now, are preliminary. They are not yet finalized and verified.

But we presented this just to give you an idea of what the results look like for a typical example.

MEMBER SIEBER: I have a question that will force you back to slide 21. The -- you have a list of systems designated for leak-before break. And the principle of being able to detect and measure the leak applies, in my mind, to all of the systems.

And when I go through the list all of them are included in the boundary of what you would measure for RCS leak rate, except main steam lines A and B. How do you detect and measure the leak rate for steam lines A and B, in order to apply leak-before break?

MR. CUMMINS: We have better experts than me on this, and maybe the Staff can help me out here. But the main steam lines are actually in a break exclusion zone when they are outside of containment.

Inside of the containment you can measure leakage and it looks like anything.

MEMBER SIEBER: It doesn't look like the sump on the old E&D argument that says all the cooling lines sweat and, therefore, have a tendency to mask small amounts of leakage, I think still applies.

MR. CUMMINS: Yes, I think that we would claim that our sump can measure .5 GPM in an hour, including the effects of condensation. And, in fact, most -- the most likely form of a leak is some kind of a steam leak, anyway.

And it just represents itself as condensation.

MEMBER SIEBER: So you can't distinguish, you can't tell the difference.

MR. CUMMINS: If you get condensation you have to call it a leak if you get .5GPM. And, in fact, the containment is air conditioned, if you will, and it is fairly dry in normal operation.

But certainly when you first start off, and when you open the containment for the first little bit of time, until you establish a humidity level, or a fairly steady humidity, you might have issues associated with being able to detect the leak.

I think after you get in a steady state humidity, then if you see a humidity change, or condensation, what you are seeing is really a leak. And you need to address that.

MEMBER SIEBER: Will the tech specs address that?

MR. CUMMINS: Yes, I think we have --

MEMBER SIEBER: -- their tech specs do not. Inside from the operator in order to interpret radiation levels, changes in humidity, and so forth, as indicators of leakage related to leak-before break systems. Is that not the case? I think it is.

MR. CUMMINS: I'm not positive. I think we actually have tech specs on measurement of some leakage.

MR. CORLETTI: We do, we do have leak detection. Our tech specs do cover that leak detection.

MR. CUMMINS: So if you get .5GPM there, you have to go investigate, regardless of where it came from.

MEMBER SIEBER: That means shutdown.

MR. CORLETTI: Well, maybe.

MEMBER SIEBER: I don't know how else you would --

MR. CORLETTI: Based on what the tech specs require, yes.

MR. CUMMINS: I think that where people have found leakage off, in this steam generator manways, and pressurizer manways, where they didn't quite bolt it back correctly, really to go inspect those you have to shutdown, because the radiation is

such --

MEMBER SIEBER: Yes, shutdown. I have a set of standard tech specs, short distance from here, and I will check that. In the meantime, do you have your tech specs with you?

MR. CORLETTI: Yes, they are in chapter 16 in our DCD, and I'm going to give you --

MEMBER SIEBER: I can compare it.

MR. CORLETTI: Yes, sure.

MEMBER SIEBER: I will compare that tonight.

MR. CORLETTI: And that is how the Staff has reviewed our tech specs, a very thorough review of every deviation to the standard. And we have had to have an explanation.

Because I think deviation based on a design difference of your plant, and it is not, we need a darn good reason.

MEMBER SIEBER: So you are comparing to the Westinghouse standard tech specs for current generation PWR?

MR. CORLETTI: The Staff has reviewed it that way.

MR. CORLETTI: Does the Staff have a document that documents that review?

MR. SEGALA: The DSER, chapter 16, of the DSER.

MEMBER SIEBER: I think I have an older version of that.

MR. ZAVISCA: This is the only version we have.

MS. STAREFOS: That is the official version.

MEMBER SIEBER: What version is that?

(Everyone speaks at the same time.)

MEMBER SIEBER: Well, I have that. My wife keeps trying to throw it away. IT has been sitting on the kitchen table for a few --

(Laughter.)

MEMBER SIEBER: Thank you.

MR. BAMFORD: This is a slide that talks about our discussions with the NRC. The AP1000 piping systems are similar to the AP600, which has been approved. And, by the way, has the same materials in it.

The evaluation of one AP1000 system is currently in progress, and I showed you an example of some of the results there. Discussions continue as to the best way to ensure that alloy 690, and 52, and 152, will be immune throughout the service lifetime of

AP1000.

Any questions that you didn't already ask?

CHAIRMAN KRESS: I have an impression that the AP1000 t-hot is higher than current operating experience, is that correct?

MR. CORLETTI: That is not correct. That is t minus 6-10. And operating plants are up to about 6-30. They did have an AP600 with 600.

CHAIRMAN KRESS: Perhaps that is what I'm remembering, is the delta there. Thank you.

MR. CORLETTI: The next presentation we have Terry Schulz on some performance issues.

MR. SCHULZ: What I'm going to be trying to talk about is kind of an overview of the AP1000 relative to the -- so I'm going to talk a little bit about the general characteristics, and things that we have done to significantly improve the performance of AP1000 relative to operating plants.

And then at the end of the discussion I will be talking about some calculations we've done on differential pressures across the sump screen.

So this first slide here is listing some of the general differences in things that relate to improvements relative to this issue.

The AP1000 has -- takes longer to get into

recirculation, anywhere from twice to four times as long as operating plants. This is the benefit in that things that will settle have longer times to settle out debris.

The floodup levels are deeper, the screens are taller, they are located several feet off the bottom of the floor, which means that stuff that does settle is less likely to somehow get at the screens.

The flow rates that are going through the containment are much less than operating plants. And part of that is the fact that we don't have pumps that are sized for early on in the accident, running through the whole accident, just turning up old containment.

Another part of it is we don't have a spray system that is washing down the whole containment, that is adding also to the flow rates, through the sumps. That reduces the velocities and the turbulence in the deep pool that we have, again makes it easier for things to settle.

We have the unique feature that we have applied to our sump screens, and I will show you what this is. But we have located a horizontal plate right above the screen, that is located very close to the top of the screen, so that debris that might somehow

be getting into the water cannot come into the water, right in front of the screen. It is physically precluded from happening.

This means we have some minimum distance, from the screen, that stuff might get in the water and, therefore, with our low velocity it is very hard for that stuff to get to the screens.

Another thing that we have done is to eliminate fiberglass insulation from anywhere where a LOCA blowdown inject can damage the insulation.

MEMBER SIEBER: I have a question about that. Does that mean that other places in containment contain fibers, insulation, of one sort or another, and that you are only using mere insulation in the blowdown damage, then?

MR. SCHULZ: That is correct.

MEMBER SIEBER: So you haven't taken the fibrous material out of containment?

MR. SCHULZ: We've taken probably 90, 95 percent of it out. But we have not taken all of it out. One of the reasons why we still have some is because we bring chilled water into the containment for our fan coolers. And that insulation doesn't work, to try to keep sweating off the cold pipe.

Now, we've carefully routed those lines

close to the containment wall to keep them as far away from blowdown as possible. But that is one example where in order to achieve the function, insulation function that we wanted to do, couldn't really use the metal insulation.

MEMBER SIEBER: On the other hand, current plants don't insulate them at all, they just rely on them to rust away, right?

MR. SCHULZ: We are trying to do a better plant design. And most of the plants don't bring chilled water in. They will bring pump cooling water, which can be cold, but our water --

MEMBER SIEBER: Well, it is colder than containment.

MR. SCHULZ: Yes, especially with a humid containment.

MEMBER SIEBER: -- condensation --

MR. ANDREYCHECK: Some of the pipes I've seen have their chilled water insulation with fibrous insulation inside containment.

MEMBER SIEBER: Some do.

MR. ANDREYCHECK: Some do, not all. But --

MEMBER SIEBER: Well, more don't than do, I think.

MR. ANDREYCHECK: I won't argue numbers but I have seen some. The other thing that is important in the AP1000 side is that it doesn't use calcium -- does not use that, we know that from the NRC researchers, particularly troublesome material.

MR. CARUSO: Do you route those lines in such a way that they are not subjected to mechanical damage during normal operation, or refueling? I mean, a lot of these lines they get very mushy over the years, because people step on them, or they bang into them, because people are just in the area.

If you locate them in a place where they are inaccessible, they just sit there. But if they are close to where people work or move, they get soft, and they get mushy, and if they get wet they just --

MR. SCHULZ: It sounds like you are talking about the silicate insulation, and we don't have any of that.

MR. ANDREYCHECK: That was the fiberglass insulation. That is why we put a plastic bundle like NUCOM, which NUCOM has a plastic tag inside a metal sheet, also, which gives you another level of protection --

(Everyone speaks at the same time.)

MR. ANDREYCHECK: -- like you put in your

attic, has metal shielding around it, does have a tendency to become broken down, if stepped on, or damage to the impact -- things like that.

MEMBER SIEBER: These lines are moderate sized lines, ring header, in a standard plant, they are ring header around the outside of the containment, which means they don't get a lot of stepping damage.

MR. CUMMINS: Very similar to AP1000. And they are relatively high elevation, they are at the top of the steam generator level, so --

MR. CARUSO: And they are wrapped in stainless, they are metal encapsulated in some way?

MR. ANDREYCHECK: I don't have the specifics on the design on the insulation.

MR. CUMMINS: I think the standard in the spec -- the standard is not encapsulated, but an outer sheet of either stainless steel or aluminum. Stainless steel or aluminum are usually what is used.

MR. SCHULZ: One other general characteristic that we have, is a little different in AP1000, is the coating used inside containment. We have specified a high density coating, 100 pounds per square foot, that if it becomes detached, will settle in our environment, very readily.

MR. CARUSO: And that is going to apply to

all the components, like the crane, so that every component supplier is going to have to use this particular type of coating, and not their standard coatings?

MR. SCHULZ: I don't think that is the way it is specified, no. It is the bulk of the walls, structural members. Something like a crane I wouldn't expect doing that. But it is not going to be imposed on everything inside containment.

We will be trying to minimize the use of coatings, in general, using ratings, and things like that, to minimize the use of coatings where it is practical.

And where we have structural steel, concrete walls, that will be specified to be high density coating, which actually will be a safety classified environmentally qualified material, but will not be required to be applied and inspected in accordance with safety QA requirements.

Because if it becomes detached, it is okay.

MEMBER SIEBER: So that is what you mean by non-safety coatings, that appendix B doesn't apply, you don't have to worry about how thick or thin it is, or whether it adheres or not.

MR. SCHULZ: Now, we are trying to -- we have a lot of input from the utilities, and they don't mind -- but the real onerous job on their part is the initial installation, and in particular the maintenance of that, and discovering that there is a little patch here, now they have to fix it, they have to shut down, and all of that.

So they encouraged us to find a better solution. So we think that buying good paint is environmentally qualified, so we expect it to stay in place, but we can't guarantee it, so we evaluate the plant, so what happens if it doesn't. And we think we have a good --

MR. CARUSO: And they are going to accept, as part of their licensing basis, the fact that they can't ever repaint inside containment for 60 years, unless they use 100 pound per --

MR. SCHULZ: Yes.

MEMBER SIEBER: That is not the big problem. I have to think about that, that is a pretty low standard set. But I guess our concern is whether it has a safety implication or not, and I will think about it.

MR. CUMMINS: Terry is going to tell you it doesn't.

MR. SCHULZ: -- on AP600, same approach. The next couple of slides are intended to give you a physical, or in some cases remind you the physical situation inside containment, and also to show you a bit more where the screens are, and how these plates are located.

This is the flowup picture that we are looking at, and --

MEMBER WALLIS: I'm having trouble with these two figures, because that shows a big pool across the bottom of the whole containment. In fact they are separate rooms down there.

MR. SCHULZ: They do connect, though.

MEMBER WALLIS: They have to somehow interconnect -- the IRWST, the real thing doesn't show any gutters at all. There are a lot of things that are in the cartoon which are hard to relate to the real picture.

MR. SCHULZ: That is right. And the reason that I made the cartoon is so that you can see all the stuff that is in the plant, which if you are looking at a general arrangement drawing the gutters would show up, not because it is not there, it is because it is too small.

MEMBER WALLIS: Then there is the screen

that we are going to talk about, and it isn't shown in the real plant, at all. Where is that?

MR. SCHULZ: Let me start here, inside the IRWST. This is a plant view, obviously. The IRWST is defined in this area, you have the passive RHR, the two spargers.

Here is one of the screens for the injection line out of IRWST. These are the injection screens, not the recirc screens. And the next figure shows a plan view, there is a pit underneath where the pipe comes out that goes to the IRWST injection.

And above that is the screen. Now, this is inside the IRWST.

MEMBER WALLIS: They are different screens we are talking about, then.

MR. SCHULZ: We don't think these screens are as at-risk in getting debris on them. They are inside the IRWST, there is limited access to the IRWST.

Yes, there can be some stuff in the IRWST. But we think, for the most part, if there are some particles or debris, it will sit on the floor of the tank and will stay there.

MEMBER SIEBER: Let me just get in my mind the general plant arrangement. The top of the IRWST

is actually the operating deck, correct?

MR. CUMMINS: Yes.

MEMBER SIEBER: But it is not a continuous deck, all the way across, in the area of the reactor it is open, right?

MR. CUMMINS: Right. There is a refueling pool. So -- but the over the IRWST there is a continuous floor. And one of the borders of the IRWST is the refueling pool wall.

MEMBER SIEBER: And do they connect?

MR. CUMMINS: Yes.

MEMBER SIEBER: So garbage that is in the refueling cavity, they can connect?

MR. SCHULZ: The IRWST overflows into the refueling pool, so they connect in that sense. And it drains into the refueling pool, that go back into the bulk of the containment.

MEMBER SIEBER: And the screen that you are talking about, for the IRWST, is in the bottom of that tank, which is shown on slide 70?

MR. SCHULZ: Yes, it is also shown in the slide right here.

MEMBER WALLIS: The gutter collects all the junk, which feeds directly into the IRWST?

MR. SCHULZ: And it goes to a four inch

pipe. So the connection from the gutter to the tank is through two pipes that are not that big.

MEMBER WALLIS: Isn't this where you are likely to get blockage?

MR. SCHULZ: I don't think so.

MEMBER WALLIS: All this paint and stuff from the containment washing down into the gutter.

MR. SCHULZ: The gutter doesn't have to work in this situation. Were you worried about the gutter bringing debris into the tank, or the gutter flow?

MEMBER WALLIS: Well, both.

MR. SCHULZ: The gutter flooding has no safety significance.

MEMBER SIEBER: In fact it would be an advantage, right?

(Everyone speaks at the same time.)

MR. SCHULZ: Now, the debris is limited in size by the pipe. There are only two pipes.

MR. CARUSO: But it brings lots and lots of little paint chips.

MR. SCHULZ: The paint it is likely to bring is the paint on the containment, and it will sink very rapidly.

MR. CUMMINS: The paint in the containment

vessel is safety related both inside and outside, not because of this issue, but because of the other issues of heat transfer, and so the containment vessel paint is safety related, including its application.

MEMBER SIEBER: And that is the bulk of the paint that is in there. You are saying it sinks, but I think in discussing AP600 we concluded that organic zinc with hot water will actually react with that, and will probably produce gases.

So the organic zinc paint pool is going to be bubbling, and probably lifting stuff up by the buoyancy of the bubbles attached to the paint, and it is not going to be just a static stuff laying ont e bottom of the IRWST.

MR. ANDREYCHECK: I have not seen the energetic chemical reactions that you described.

MEMBER WALLIS: Well, it takes a -- I guess my colleague Dr. Powers assured me that this zinc paint will tend to react and produce gases.

MR. ANDREYCHECK: It is true that the zinc will react with boric acid solution, generally hydrogen.

MEMBER WALLIS: Right, hydrogen makes bubbles which don't escape from these paint chips, they stick to them, and they make the --

MR. ANDREYCHECK: Well, first of all, zinc doesn't stick to --

MEMBER WALLIS: Well, it does on some --

MR. ANDREYCHECK: Not zinc, zinc doesn't fail that way, zinc --

(Everyone speaks at the same time.)

MR. ANDREYCHECK: And because it is powder it will tend to reside on the surface of the --

MEMBER WALLIS: I think it will go up and down.

MR. ANDREYCHECK: It depends on the circumstances, it can actually penetrate --

MEMBER WALLIS: That is right. It doesn't take much of a bubble to lift the particle --

MR. SCHULZ: I think we are forgetting that that paint that we are talking about is safety related in terms of its application, its design --

MEMBER WALLIS: Well, the question is, what is its reaction with the boric acid, does it make bubbles? If it does, then you can no longer think that they are just sinking.

MR. SCHULZ: It is still attached, it doesn't become --

MEMBER WALLIS: It is floating down into the IRWST.

(Everyone speaks at the same time.)

MR. SCHULZ: I was starting to talk about the bulk of the paint in containment, but I had not mentioned that the paint on the inside of the containment surface is an inorganic zinc, is safety related, including the material, its application, and inspection --

MEMBER WALLIS: And it is guaranteed not to come off, is that it?

MR. CARUSO: What about the paint on the crane, the polar crane? Where is that going to go?

MR. SCHULZ: Depends on where the crane is located. Some of it may get down into this gutter.

MEMBER SIEBER: But that doesn't have the zinc problem, right?

MR. SCHULZ: That is right, it does not have the zinc problem.

MR. CARUSO: But that is also not going to be 100 pound per square foot paint. It will be whatever the --

MR. CORLETTI: The majority of that crane is structural steel, which will be painted in accordance with the --

MR. CARUSO: It will be painted by the COL holder, or will it be painted by the crane

manufacturer, or will deliver a completed crane to the site, and have it lifted in place by your planning thing here it says, okay, we put the rail in place, then we will put the crane --

MEMBER SIEBER: It is painted before it gets there.

MR. SCHULZ: There is going to be a lot of stuff that is going to be built in factories, okay? You've heard modules, okay? And a lot of people are going to have to have this paint to settle out with the cement particles where the steel --

MEMBER SIEBER: I take it containment is just one single fire here, right? It is not compartmentalized for fire?

MR. CUMMINS: Well, we've designed for fire analysis purposes into zones, and we do do analysis of the fires in zones. But it is one single fire area.

MEMBER SIEBER: And so you really don't need fire barriers for penetrations, right?

MR. CUMMINS: As a general rule we haven't provided fire barriers. But where we have, we have an objective of keeping division of A and C separate from B and D, in the containment, just because it is redundant operating device.

So A and C goes to one DVI train, and B and D go to the other. And so wherever, in this one place in particular, where they enter the containment, we put fire barriers around two of the divisions, so that they don't interact with the other two.

MEMBER SIEBER: And what are they, what are those fire barriers made out of, thermal --

(Everyone speaks at the same time.)

MR. CUMMINS: No, it is a steel plate composite with concrete, cement in between, and there are some fibers to try to pull the things together, but that is about it.

MEMBER SIEBER: Like your modular sandwich?

MR. CUMMINS: No, it is not, sort of a cross between a wall, like this, with a metal screen, or --

MEMBER SIEBER: So you would not use the ordinary fire barrier stuffing any place?

MR. CUMMINS: No.

MEMBER SIEBER: For a number of reasons.

MR. SCHULZ: Not on the containment.

MEMBER SIEBER: For a number of reasons. For example, if you had blowdown it would blow out all that stuffing, anyway. And the other one is to keep

the fibrous material out of containment.

MR. SCHULZ: Right.

MEMBER SIEBER: Thank you.

MR. SCHULZ: Now, we've had some discussions, recently, with the Staff about the potential for resident debris, there will be a program to keep the containment clean, but they can't keep every spec of dust and dirt in here, and maybe clothing, fibers and layers, out of containment.

The operating plants have assumed, in their evaluation, somewhere between 100 and 500 pounds of this resident debris. And we have performed an evaluation to consider this debris, and the potential for it getting onto the screens.

MR. CARUSO: Plants like to prestage a lot of material into containment before refueling. They are bringing in wood for scaffolding, the HPs love to bring in rolls and rolls of plastic sheeting that they lay down on the floors, and they put it all up in place.

The welders bring in blankets and material to put up, because they know they are going to have to go into an area to do some welding, so the bring it all in, and they have it all in place.

Does this mean that you are not going to

let licensees prestage material for refueling outages?

MR. SCHULZ: You don't prestage in the containment.

MR. CARUSO: I have seen plants do that, they do that. The HPs, the refueling machines are typically wrapped in plastic because the HPs don't like it to get the -- the contamination to get lose. And they put up all sorts of boxes, they put up plastic sheeting all over the place. How is that controlled?

MR. SCHULZ: Well, it is not allowed in the containment before refueling operations. We have a staging area in the AP1000 that is just outside the containment, so they can stage it close to containment but not inside.

MR. CARUSO: And you are going to make sure that the HP types don't leave any plastic sheeting inside the containment during normal operation, they are going to leave -- the refueling machine is going to be radiologically clean so it doesn't have to be bagged?

MR. CUMMINS: I don't think that that is the requirement. That it has to be radiologically cleaned in a controlled area.

MR. CARUSO: Well, if you have any plant,

you will find that there are components all over the refueling floor that are wrapped in plastic sheeting, because the HPs say that is how to keep the contamination attached to the materials.

MEMBER WALLIS: Well, presumably one plastic sheet can't get to the screen, because if it did, it wouldn't take much of a plastic sheet to cover it.

MR. SCHULZ: That is true for any --

MEMBER WALLIS: -- plastic sheet getting to this place where the screens are?

MR. SCHULZ: Well, most of the operating plants, I'm thinking of BWRs.

MR. CARUSO: But in this case, I mean, what do you do?

MR. SCHULZ: You have to preclude what you put in there --

MR. CARUSO: Is that documented someplace?

MR. SCHULZ: The COL will develop a cleanliness program which is consistent with the design of the plant, in terms of recirculation.

MEMBER SIEBER: In our plants, right before you did containment close out, there was a suite set aside one or two shifts, where everything was brought out, and then there was final inspection.

But that is just a couple of units.

I don't know what other people do, because I was never there in any other plant during the closeout. And before they closed out, and after they closed out. But our plants, everything was pulled out.

MR. ANDREYCHECK: Many plants have a solution program, they do exactly as you suggested.

MEMBER SIEBER: And you have to account for everything.

MR. ANDREYCHECK: Yes. And at that point with things like plastic sheeting, they are supposed to look for things like masking tape, trays, so on and so forth. Yes, loose stuff, loose tags, paper tags, those are all supposed to be identified, removed, post, before you seal up the containment and go back up to power.

But that is what solutions programs are designed to do, so that type of material was not left inside the containment.

MEMBER SIEBER: Yes. One of the issues there, that was of concern, is a lot of licensees use strippable paint to decontaminate the refueling cavity. And the question is, do you get it all out? And if you don't, where does it go during a LOCA?

And the object for everyone that I knew that did that, was to get it all out.

MR. SCHULZ: Okay. This slide and the next slide talk about analysis that we have done to evaluate the differential pressure that might be caused by the resident debris, these 500 pounds, assuming that it is 50 percent fibrous, 50 percent particle, which would be a challenge for the system.

If it was all particle none of it would get trapped by the screen. So some of it has to be fiber to allow the fiber to trap the particles. We assume that all of that 500 pounds go out to the worse point, either one of the screens, whatever we were evaluating.

Actually it was three separate evaluations to be done. Before we go on, I've mentioned here that we have done this in -- based on a NUREG. We have recently, we've had the discussions with the Staff about whether we did this correctly, and there was some question raised by the Staff that maybe we hadn't.

And in fact we have discovered, recently, that it wasn't quite right, and we are in the process of fixing that. We don't think it is going to have a significant impact on the results I'm going to show

you, but we will be talking with the Staff, in the next week or so, and present them a revised assessment and description of the -- of this analysis that I'm going to show you here.

But what we looked at is this debris getting to three separate areas. And in these three evaluations we have taken the whole 500 pounds and considered it getting to the IRWST screen.

Or all of the 500 pounds getting to the containment recirc screens, or in the final case we looked at a case where you might have had a break of a pipe that gets flooded, and some of the debris would get into the core.

Now, there it would end up splitting the amount, apportioning the debris, depending on the integrated flow through the break, versus through the screens.

So here you basically see the results of the evaluation. For IRWST screens there will always be flow through both the injection screens, even with a single failure, even with a DVI break.

And so we proportioned the 500 pounds, we put it all inside the IRWST, but we split it equally between the two screens. Now, one of the screens is actually connected to the reactor vessel, and all the

injection from the IRWST has to go through that screen.

So that is what we ended up evaluating with the DP that is very small, a quarter of a psi, at the steady flow rate. And if you compare that differential pressure, to the differential pressure in that injection mine, at this time, it is very small, it is insignificant.

So the potential degradation of the injection is not going to be important. And, by the way, when I was talking to you, two days ago, about my long-term cooling analysis, and my sort of hand calculation, I've actually put these BPs into that analysis.

But they are not in the NOTRUMP analysis. For the containment recirculation screen, it is possible there, after a DVI break, to have only one of the recirc screens available. And because you could flood the squib valves, and they might not work. They are designed to work, but they are not qualified to work.

If that is the case then all the recirc would be coming through one screen. So in that case we piled all the 500 pounds of fiber and particles, onto the one screen, and you get a little higher

pressure drop.

Also during the recirculation, the pressure drop through the recirc lines is a bit lower than the injection line, so this represents the figure percentage increase in the resistance of the flow.

The recirc flow, in this case, might decrease ten percent, which our assessment was, was not that significant. In addition if you, for example, considered instead of the worse possible recirc line resistance, a more best estimate resistance, that would compensate completely for the presence of this debris.

MEMBER WALLIS: All these delta P add up in the Bill Brown analysis because they changed his curve. So I don't think this is saying is 10 or 20 percent results, or whether it is 29 inches level, you have to look at what effect this has on that window of non-coolability, or whatever you want to call it, than Bill Brown talked about. It is going to move his curve over.

MR. CUMMINS: Bill Brown's curve was for IRWST injection.

MEMBER WALLIS: Yes, that is what this is.

MR. SCHULZ: Well, the top one, which is much minor impact --

(Everyone speaks at the same time.)

MR. SCHULZ: Mine included both of these effects actually simultaneously. In my analysis. So from the plant analysis that I did, it included that.

CHAIRMAN KRESS: How do you calculate this BP, do you take a given thickness of this stuff, and see how much area it blocks off for that thickness, and the rest of the area is what is left for the flow?

MR. SCHULZ: Yes, you basically -- you go through a process that, again, is documented in this NUREG, and it is related to the amount of material you put on.

So we relate the 500 pounds, we split it 50 percent fiber, we put it onto one or two screens, depending on where we are analyzing, and that builds up a thickness. Then you consider putting particles in there, and the flow of DP, and that can compress the bed, and which then allows for, say, less porosity, less holes through the debris.

CHAIRMAN KRESS: So you put that much weight over the whole surface area?

MR. CUMMINS: That is correct.

CHAIRMAN KRESS: And that fixes your thickness, then?

MR. CUMMINS: Yes.

CHAIRMAN KRESS: And then because you know the density of the stuff?

MR. CUMMINS: That is correct.

CHAIRMAN KRESS: And then you compress it a little bit, so you've got a different density.

MR. CUMMINS: What causes the compression is the flow --

CHAIRMAN KRESS: And then you have a correlation, somewhere, for DP versus this thickness, as compressed, and that comes out of -- somebody measured that somewhere, did they?

(Everyone speaks at the same time.)

CHAIRMAN KRESS: That was a Los Alamos paper?

MR. ANDREYCHECK: Yes, NUREG 6224 has a good basis for it, and so flat screen, flat plate type pressure drop. And the -- it is generally considered conservatism. If you normally apply the fiber across the screen, and then apply the particulates uniformly on that, anything that is non-uniform tends to give you a smaller head loss across the screen.

MEMBER WALLIS: We have very little idea what this resident debris is.

MR. ANDREYCHECK: And there is a current program in place, and I worked in Los Alamos, and the

NRC, to try to determine that. Five plants have agreed to provide samples of resident debris.

MEMBER WALLIS: All you need to do is vacuum the containment a few times.

MR. ANDREYCHECK: Actually, there are two types that actually wipe out, do a power wash of the containment, and they use it primarily for purpose of decontamination, but they get an amazingly clean containment. There are two plants that I'm aware that do that. I think there are several others. But that is a good point.

As part of their containment close out, just before they go back up to power.

MR. SCHULZ: The final evaluation we did was considering some debris getting into the RCS and bypassing the screen. And again this is -- this would have to be some neutrally buoyant fibers, which is what we assumed for the other two cases.

And we split these 500 pounds of debris, again, 50 percent fiber, but it would be into sort of integrated flow rates for several hours, we get about 40 percent going through the recirc screens, and about 60 percent going through the break.

And so we took 60 percent of the debris, and put it in the reactor, and build up a bit inside

the --

CHAIRMAN KRESS: Once again using the same process?

MR. SCHULZ: Same process, how thick the bed is, and what the flow rate -- now, of course the flow rate here is the total flow rate from the break, and from the screens, and DVI lines, and get about a one psi pressure drop. The area in the core is not as big as the screens.

Now, in this time frame with this flow rate, is shortly after recirculation begins, so the flow rates are still fairly high. This is about the maximum recirc flow rate that we have seen.

Now we relate the downcomer densities that we have to about 29 inches a head extra that we would need, to overcome this BP that we added to the core. And what I looked at was the WCOBRA/TRAC long term cooling analysis, which showed that the water level was more than twice that below the DVI connection.

So that by backing it up some, basically, you were not imposing any increase in the injection pressure. If you backed up the water to at or above the DVI connection, now the DVI connection would see some additional back pressure.

CHAIRMAN KRESS: What if you put that

debris, if you put it on different areas of the core?

MR. SCHULZ: We looked at two different cases.

CHAIRMAN KRESS: So that you blocked up just part of the core, and what will that do to that set of fuel channels that is blocked.

MR. SCHULZ: Ken has some analyses that they have done on operating plants. It wouldn't completely block it. Again, this is porous. So water would still get --

CHAIRMAN KRESS: -- cross flow --

MR. SCHULZ: And that is the other point that Tim was going to talk about, where they actually looked at the cooling --

MEMBER LEITCH: -- containment --

MR. ANDREYCHECK: We looked at blocking the bottom of the core for 3,400 megawatt for PWR, and we did parametric studies looking at 20, 40, 60, and 80 percent blockage.

And we started assuming the blockage in the center of the core had worked out radially, so we were getting water around the periphery. Having to get to the hot channels and the center of the core.

We were able to demonstrate, analytically, that we would get sufficient amount of cross flow,

through the channels, that with 80 percent blockage we would be several hundred degrees away from fuel clad damage.

MEMBER WALLIS: -- self correcting in the hot channel, and that means the hydrostatic head goes sideways?

MR. ANDREYCHECK: But we did get added water flow from the periphery, into the center of the hot channel, and provide adequate cooling for clad damage.

MEMBER WALLIS: So this 500 pounds seems just a number that came from somewhere?

MR. ANDREYCHECK: It came from the NRC study for GSI-191 --

MEMBER WALLIS: It seems somewhat unrealistic.

MR. ANDREYCHECK: That number was based on scaling from PWR sump screen blockage issues, based on surface area of PWR containment versus --

MEMBER WALLIS: So is 500 pounds of debris being likely? There is no evidence of 500 pounds being likely?

MR. ANDREYCHECK: No, there is none. In fact, the NRC's study looked at scaling and said that the range that they would get from the surface areas

of PWR and BWR containments was between 100 and 500 pounds.

We chose 500 pounds as a maximum amount, and typically we would not expect to see that amount. And this was, again, particulate and fibrous debris.

MR. SCHULZ: The last couple of slides talk about the coating failure, and some settling calculations that we have done.

Again, we don't expect the coatings to fail, because we are putting in qualified coatings. But we think we can't tolerate the failure of the coatings primarily because of the requirement that they be of high density.

MEMBER WALLIS: Now, these are coatings? How about rust?

MR. SCHULZ: There should not be any rust.

MEMBER WALLIS: Rust on your water lines.

MR. SCHULZ: The water lines are insulated, and they would be -- they would have a coating on them. The rust also, I would think, would be heavy, would settle.

Again, the characteristics of the --

MEMBER WALLIS: Well, there is rust on the reactor vessel, there is rust on quite a few things.

MR. SCHULZ: Not really rust, no, oxide.

MEMBER WALLIS: Well, oxide is rust.

MR. SCHULZ: It is not like, you know, -- it is a thin film that, I think, would also be high density.

MR. ANDREYCHECK: If you are looking at a parallel between the migration of corrosion, in the PWR sense, and BWR issues, with what we have in the AP1000, there was a high velocities in the taurus and the suppression pools that tended to migrate and move.

And there is also very energetic steam bubble collapsing that tended to stir pools up, that would move and make transportable the corrosion products, which have a tendency to sit on the bottom of the pool.

MEMBER WALLIS: I understand there is quite a lot down there.

MR. ANDREYCHECK: It could be, I'm not familiar with -- but the -- for the AP1000 as pointed out by Terry, the velocities, even in the pools, tends to be fairly low. And products that have a tendency to have higher specific gravities, and the 100 pounds per cubic feet of coating density gives us a specific gravity of approximately 1.3. And iron oxide is above that, as I recall.

So the tendency would be for those

products to settle out. We chose very light density products to do these analyses, even the fiber and the particulates. Everything that you are running up, in the way of other products, corrosion and also galvanized products that might be subjected, would have a tendency to have a higher specific gravity, and would have a tendency to settle in this particular kind of environment that we are talking about, very low velocity, throughout the entire region of the AP1000.

You see, here --

MEMBER WALLIS: Davis Besse was a PWR.

MR. ANDREYCHECK: Davis Besse is a B&W design --

MEMBER WALLIS: And they had 900 pounds of solid material on top of the head, or something like that? There are ways in which you can build up corrosion product, and other things in the containment, if you don't pay attention.

MR. ANDREYCHECK: You are correct, if you don't pay attention. And, in fact, they had other things staged inside containment, like power washing equipment, to clean off their fan coolers, which tended to clog with boric acid.

MR. CARUSO: What drives this is they

can't afford to shut down an extra day in order for refueling. They are trying to cut down on refueling times.

MR. SCHULZ: We have addressed that by providing a special area, just outside the containment, and very easy access in the containment, so that they only have -- the problem is getting stuff into containment, like they do today.

CHAIRMAN KRESS: I hate to cut this short

MR. CARUSO: The plant I remember most vividly is Connecticut Yankee. It is gone now, but they had built cages inside the containment, that held all of the supplies that they would need during refuelings and they had these enormous metal cages built inside containment, that held rolls of polyethylene, and staging, and welding supplies.

And then there were piles of wood for scaffolding all over the place.

MR. ANDREYCHECK: I'm not disagreeing with you, but I think the issue that NRC has brought to light is making utilities to take a look at what they are doing.

Your point is well taken, that wasn't -- that was the way things were done in the past, I'm not going to disagree with you on that. But I think

that if you are looking at across the board, as Terry mentioned, for AP1000 is addressed by the staging area outside --

CHAIRMAN KRESS: I think all of this is not part of design cert review, this is an issue, or a set of issues which are the review of the cleanliness program of the COL applicant.

MEMBER SIEBER: Do you have an equipment hatch in the AP1000?

MR. ANDREYCHECK: We have two, sixteen foot --

MEMBER SIEBER: Where are they? I mean, do they open up into a building, or do they open up to the blue sky?

MR. ANDREYCHECK: Into the annex building, this is what Terry was talking about.

MEMBER SIEBER: Both of them?

MR. ANDREYCHECK: Both of them do.

MEMBER SIEBER: If you were going to change a steam generator, which I'm sure you don't anticipate --

MR. ANDREYCHECK: The steam generator is too large to get through the equipment hatch, and the method of removal is to lift it with a polar crane, and then lift it up the top of the center of the

exhaust, if you will, of the PTS. We cut the steel containment. There is no structural concrete there, and lift it up through the top.

CHAIRMAN KRESS: I hate to cut this off, I think we are running short on time. Let's see the figures.

MEMBER WALLIS: The higher flow takes the debris close to the screen, presumably.

MR. SCHULZ: What this means is that -- no, they are not reversed, it is a communication issue here. In the case one we assume higher flow coming from the front of the screen, and lower flow coming from the side.

In the case two it was a different scenario where we assumed uniform flow out at the edge of the screen, coming from both the front and the side. So when it says higher flow, it means higher flow approaching the front of the screen, which is the side of the screen.

So it is conservative, the cases one is showing you the approach from 10 foot away, from the front of the screen. The plate extends out seven foot to the one side.

MEMBER WALLIS: So this is the sump size particle, and there is only one particle that is going

to take that trajectory?

MR. SCHULZ: Yes.

MEMBER WALLIS: And there is a whole distribution of particles?

MR. SCHULZ: And densities, right.

MEMBER WALLIS: So it doesn't really give the picture very well.

MR. SCHULZ: It depends on what picture you are trying to show, right.

MEMBER WALLIS: Well, I mean, another one is to the screen, the big ones fall down.

MR. SCHULZ: Possibly.

MEMBER WALLIS: Yes, they will.

MR. SCHULZ: Well, Graham, there is an issue here with fluttering, smaller particles won't tend to flutter as much as bigger particles.

MEMBER WALLIS: Well, we had a talk with Graham McIntyre about maple trees, and the leaves that come down, I remember that. They flutter, they don't go straight down.

MR. SCHULZ: But if you get a small particle it is going to tend to not --

MEMBER WALLIS: The whole point is that there isn't just one trajectory.

MR. SCHULZ: I'm not saying there is.

This is giving you a feeling for the extreme --

MEMBER WALLIS: This is the extreme case?

MR. SCHULZ: The extremely low settling velocities you would need, in order to challenge the screen.

MEMBER WALLIS: Well, I don't know yet, because I don't know what particle you are talking about and so on. So I guess this is all in the hands of the Staff, the Staff is going to follow this up, and make sure it is done right?

MS. STAREFOS: Yes.

MEMBER WALLIS: Now, what is the size of the particle in this trajectory?

MR. SCHULZ: The particles were, are basically a quarter inch.

MEMBER WALLIS: A quarter inch in diameter?

MR. SCHULZ: They were selected so that they could potentially clog the screens.

MEMBER WALLIS: So they are big particles?

MR. SCHULZ: They were selected to be big enough to challenge the screen.

MEMBER WALLIS: So they are pretty big?

MR. ANDREYCHECK: Yes.

MEMBER WALLIS: So little particles would

have gone right to the screen, in this picture? They got through the reactor and everything else.

MR. ANDREYCHECK: And in fact there were velocities in the reactor where --

MEMBER WALLIS: Another interesting question for you guys is why a quarter inch mesh? I mean, the mesh should be designed in anticipation of the kind of debris you are likely to get.

MR. SCHULZ: Well, that is not how it is selected, it is to make sure that everything downstream, including -- in operating plants that includes valves, pumps, as well as the fuel --

MEMBER SIEBER: Can take the debris.

MR. SCHULZ: That is right.

MEMBER SIEBER: So it will catch a bolt, or something like that?

MR. SCHULZ: It is intended to catch stuff that could cause blockage downstream.

MEMBER WALLIS: Beer can or something.

MR. CARUSO: But the fuel debris screen are a lot smaller than a quarter inch?

MR. SCHULZ: Not for this plant.

MR. CARUSO: I thought you were going to use a standard Westinghouse vantage fuel design?

(Everyone speaks at the same time.)

MR. SCHULZ: We will be using the standard fuel design, yes.

MR. CARUSO: And that has debris screens that have holes that are --

MR. SCHULZ: -- will be consistent with this screen size.

MR. CARUSO: So it is going to be different than the one that is currently in --

MR. SCHULZ: That may be the case, yes.

MR. CARUSO: Does that mean, then, that the competition decides to try sell a reload, they are going to have to sell a downsized debris screen? The reason I ask is fuel is not part of this review, right?

MR. SCHULZ: That is not true, fuel has been a part of the debris.

MR. CARUSO: Is that constraint part of the DCD, is that explained in the DCD, that the fuel debris screen has to be --

MR. SCHULZ: The latest South Texas, or the latest design is consistent with a quarter inch. The latest South Texas fuel assembly -- I'm saying south Texas because I know that is -- so our latest fuel design is consistent with that.

MR. ANDREYCHECK: The design for Calloway

is consistent with the licensing requirements to REG guide 1.82, which does say that some screens eliminate -- in their ECCS flow path, and that includes the sprays.

MR. CARUSO: Is that a requirement in the DCD that the fuel --

MR. ANDREYCHECK: I can't answer that.

MR. SCHULZ: Yes, it is a requirement that the quarter inch be limiting blockage -- yes, it is in the DCD.

MR. CORLETTI: The next presentation, and I think we can just drive through this one in five minutes, on INC, because we are going to be showing you our INC --

MR. SOBROSKY: This is Joe Sobrosky, I was hoping to kill an action item. We have John Lenox here, from this morning there was questions from Joelle's presentation about the associated Westinghouse calculation, and identified assumptions with the (inaudible) --

MR. CORLETTI: I understand that, and we've been looking at that as well, and when you told us that last night, we understand that.

MR. SOBROSKY: Yes, but when I heard this morning we said that we had John Lenox available to

address that if the ACRS was interested in it. So before I let John go, did we want to address that question?

CHAIRMAN KRESS: I think we will just let you two work it out, and then we will look at it.

MS. STAREFOS: Thank you, John.

CHAIRMAN KRESS: Thank you.

MR. HAYES: The primary purpose for this part of the agenda is simply to prepare you for this afternoon's session out at the automation headquarters. When I refer to 286, that is what we are talking about.

There is actually two specific places out there where there will be presentations. One is an INC product demonstration, presentation and demonstration. And one is presentation in what we call the advance control room development facility, where we are looking at concepts of advanced control rooms.

The main point I want to make in all of this is what you see this afternoon is not AP1000 specific. I almost want to say it is not AP1000. But, yes, those products will be in the AP1000.

But those people are not involved with AP1000 today, they are involved in product

development, they are involved in developing boxes that will ultimately be used to put together to make an INC system.

The reason I can say that is because for INC, and for human factors, we took a slightly different approach from what we did in the fluid systems. And that is what we certify, as part of the design certification, is the INC design process, not the design.

In addition to that, in the certified design, or the functional requirements for the INC, in fact we talked about some of them yesterday, when we talked about squib valve control. But the actual design of the INC, the computers and how they talk together, the details of that design are not made.

What is certified is all the requirements on the design when it is done. The COL will be obligated to show that the final design meets those requirements.

Why did we do that? This is consistent with what was done with the other design certification plants. The world of computers is moving very fast, and we don't want to freeze a design today, when the plant may not be built for a number of years in the future.

So the intent is to allow current technology, whatever current means, today we are saying those words. And to give you an example, when we licensed AP600, we did design certification for AP600, we expected a product we called "Eagle" to be the safety system.

Today we don't make Eagle any more, or we are in the last throes of making Eagle. It has been replaced with something called Common Q. Functionally it is very similar, but is newer design, using newer electronics, based on current design of electronics.

But on the other side of this I want to point out that, again, for this afternoon, those products are not just AP1000/AP600 products. They are used in other places, and including upgrades in other American plants.

So just in the short time frame of the AP600 and AP1000, we changed the safety product. We did not change the non-safety product, but that is because it changed during the AP600 design process.

So my point here, and it is really only one point, please understand, when you are out there, this is not AP1000, although it relates.

But part of what we would like you to come away with, from the visit out there, is more than just

your AP1000 review, because you guys are interested in other U.S. plants, also.

Now, with that, I will turn it over to Bob Fuld, who is our leading human factors person, and he is going to talk about the control room design and tell you, essentially, the same story about the control room.

MR. FULD: Thanks. I will try to be brief since we are behind. I'm not really sure what you thought I might address understand design acceptance criteria, but I have done this sort of literally, which is to say practically we were dealing with the design acceptance criteria are under human factors.

I believe you are all familiar with ITAAC, that is table in the tier 1 of the DCDs, in the various Q1 sections, they all have -- design commitment, the inspections test analysis column, and the associated design acceptance criteria, or DAC.

I believe what they do is provide a firm commitment to auditable, or verifiable results and acceptable conclusions in tier 1, which makes it very formal, and difficult to change, without a great deal of scrutiny.

This is to provide closure to the part 52, the one step licensing process for ALWR plants. And

it is the responsibility of the applicant, the license applicant to satisfy these criteria but the vendor, of course, or anyone else can do it ahead of time, and the COL applicant will be happy.

With respect to human factors engineering, I think you -- of human factors engineers for different reasons, and different context, and are familiar with --

CHAIRMAN KRESS: Is that a definition, that first bullet, of human --

MR. FULD: Well, that was my definition, for lack of a better one. How do you like that definition?

CHAIRMAN KRESS: We will take it, that is all right.

MR. FULD: That is good. I'm happy with it, too.

In the part 52 licensing process human factors has emphasized review of the design process, as opposed to, perhaps, more product related orientation for the plant design fleet at this time.

But the process review is guided by NUREG 0711. I think you are familiar with this. The product review, such as it remains, is guided by 0700, and I have added validation test results to that,

because I don't want the importance of this to escape mention.

So I will propose a human factors DAC confirms closure of the open elements of the human factors plan, that is the 0711 plan, related plan I should say. And a second overlapping item that I have is that it confirms specific aspects of the tier 1 design description requirements for the control room, the shutdown room, and the local control stations, to have been met satisfactorily.

And this was already done for the first item, and I could probably add to this list with other things that are, likewise, largely redundant, but I wasn't sure that it was necessary.

If I were to add a third I think it would be the B&B activities that we conduct, which is also redundant with each of these things, to some extent, a subset.

For AP1000 it is listed in the table in section 3.2 of tier 1, in the DCD. It has 13 line items, some of those have a similar number of items, and each of those can stand for relatively large activities, so it is very high level in the hierarchy.

But the design acceptance criteria, the formula if you like, typically states that something

like a report existing concludes that something for required inspection to confirm that that specific item has some characteristic or object.

And this is sort of the boilerplate of the DAC. So this sort of brings me to the end of looking at DAC, here. DAC COL commitment in DCD tier 1, so it has a lot of legal clout, so that they are auditable or verifiable results, and acceptable conclusions with the design that they have been met.

These commitments include, for human factors, is the B&B activities, which is line 5, primarily. And this brings closure to the human factors design process in 711.

And if there are any questions?

MR. CORLETTI: I think --

MR. HAYES: Part of the reason we wanted to mention this is because you will see what we call the control room development facility, that looks a lot like the AP1000 control room, but it is not. And it is close enough that it confuses a lot of people into thinking that they are looking at --

(Laughter.)

CHAIRMAN KRESS: Before we close I think we probably ought to talk about this next meeting, which right now is scheduled for September. As far as

I'm concerned we can leave it in September, because I'm going to view it as more of a progress report for the full Committee, some of what we have already heard here.

And my suggestion is, for example, that for the Westinghouse people, that we have two hours, and that is to be split between Westinghouse and Staff, and I think Westinghouse get the bulk of the time.

And I think we ought to discuss progress on what I view was ACRS concerns. And I would list these, like in the thermal-hydraulics area, I would say the entrainment issue, the level swell issue, and the boron precipitation issue.

And maybe cover these somewhat with the bounding and simplified approach. The other issues that I think might be of interest, that were brought up by ACRS members, are the containment lambda, make it a lot shorter than what we heard before.

And vessel retention, particularly the question of where and how it breaks through the vessel, and how that relates to the fuel coolant interactions.

And the squib valve reliability, you will -- we will have to convince Steve Rosin that that is

okay. As far as the containment lambda, I would say here is the -- why we chose this particular sequence to look at, to validate what we use, and how that translates into the lambda.

I don't know, do any of the members have any choices, what about the thermal-hydraulics, did I choose --

MEMBER WALLIS: What do you think about the screens, the sump screens? Can you do that quickly? Because it is an issue that we are aware of.

CHAIRMAN KRESS: Yes, I think that ought to be part of it. Now, for the Staff, we would like a status report on the open items, and maybe some of the stuff that was presented to us on the confirmation calculations using RELAP.

And I don't think they have time for much more there, but that would be my guess.

MR. CORLETTI: So you want about two hours, an hour and a half from Westinghouse, and 30 minutes from the Staff?

CHAIRMAN KRESS: Yes. And you have to of course account for time for questions. But that would be about my guess of the split.

MEMBER WALLIS: I think the more complete your presentation, the more convincing, the fewer the

questions, hopefully.

CHAIRMAN KRESS: Well, you can't count on that.

MEMBER WALLIS: It is a self-reinforcing thing, if you are disorganized, then you will get more questions, and you get even more disorganized, and you will take longer and longer.

MR. CUMMINS: We will try to do a good job.

CHAIRMAN KRESS: Before we close I would like to thank everyone. It has been a very good meeting, I think we see a lot of progress. I particularly thank the Westinghouse people for their hospitality, and their good presentations. And Staff was -- your openness was very good, so I think it has been a very good meeting.

MR. CORLETTI: We appreciate coming to Pittsburgh, and the disruption, but we were really excited to have you here, and we are glad you came to see us.

CHAIRMAN KRESS: I declare the meeting adjourned.

(Whereupon, at 12:50 p.m., the above-entitled matter was adjourned.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Reactor Safeguards Subcommittee on Future Plant Designs

Docket Number: n/a

Location: Monroeville, PA

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Donna Willis

Donna Willis
Official Reporter
Neal R. Gross & Co., Inc.

DSER Open Items
Planned Resolution Paths

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DSER Open Items Already Discussed with ACRS

AP1000

- ☑ T&H Issues
- ☑ PRA
- ☑ Seismic and Structural Design
- ☑ Leak-Before Break
- ☑ Sump Performance Issues
- Security
- Control Room X/Q
- 10 CFR 50.44
- ITAAC

DSER Open Item: Security

- **Security is largely the responsibility of the COL applicant**
- **Westinghouse has submitted a Security Assessment report to NRC**
  - Assess design features of AP1000 and their compliance to design-related requirements contained in the revised Design Basis Threat and Interim Compensatory Measures
  - AP1000 complies with applicable requirements
- **Review was delayed due to NRC staff resource issues in this area but review is now underway**

DSER Open Item: Control Room X/Q

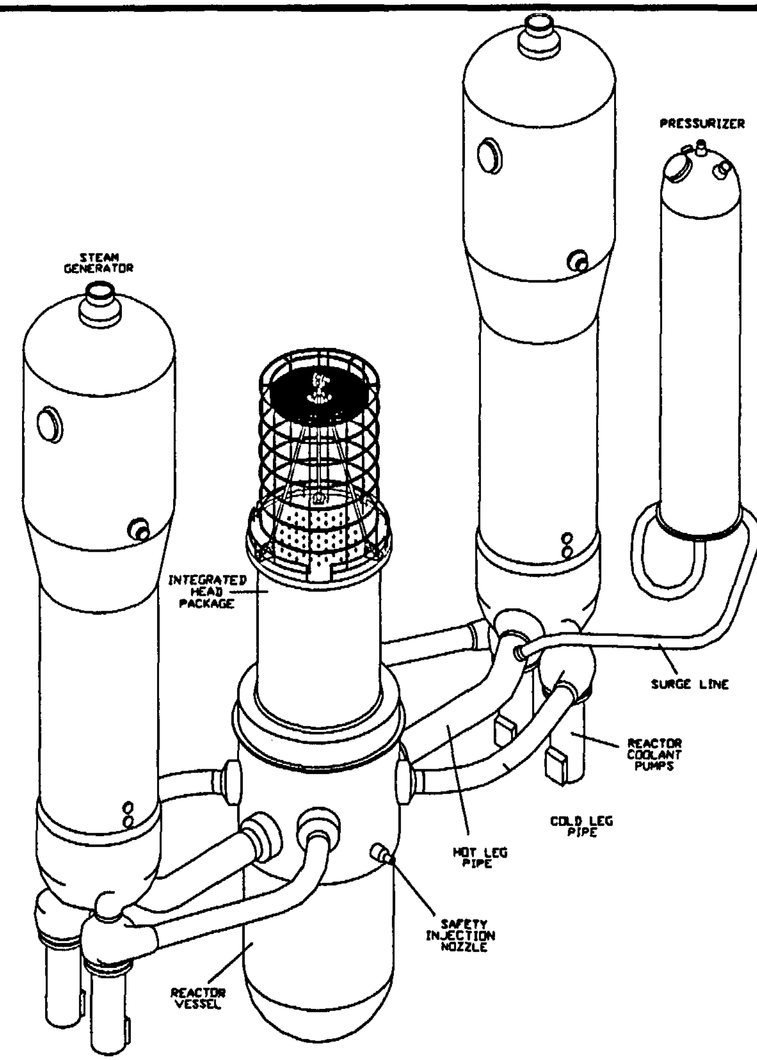
- **Main control room doses are calculated for design basis accidents**
  - Atmospheric dispersion factor influences dose rate
- **AP1000 control room X/Q was performed using same methodology as applied to AP600**
- **NRC Reg Guide 1.193 issued in June 2003**
- **DSER item requests a comparison of AP1000 calculation to the Reg Guide**
- **Westinghouse is preparing a compliance summary to Reg Guide 1.193**

DSER Open Item: 10 CFR 50.44

- **10 CFR 50.44 - Standards for combustible gas control system in light-water-cooled power reactors**
  - Regulation is undergoing revision
    - Relaxation of the requirements regarding hydrogen recombiners
    - Expected to be issued this year
- **AP1000 has been designed considering new requirements**
  - Passive H2 recombiners are still provided
    - Not required based on new regulation
    - Provided for defense in depth
    - Same design as AP600; downgraded safety classification

AP1000 Proven Components

- **Core**
  - 14 ft / 157 Fuel Assemblies
  - Doel 4; Tihange
- **Reactor Vessel - 3XL**
  - Same OD as AP600
  - 60 year design life
  - No welds in high flux region
  - No bottom-mounted instrumentation
- **Δ125 Steam Generators**
  - ANO RSG / CE System 80
- **Reactor Coolant Pump**
  - Canned motor pumps
    - No seals / high reliability
    - Naval reactors; AP600
- **Simplified Main Loop**
  - Same as AP600
  - Reduced welds / supports
- **Pressurizer**
  - 50% larger than similar units



AP1000 DSER Open Items

July 18, 2003
ACRS Future Plant Subcommittee Briefing

Joelle Starefos, Project Manager
Office of Nuclear Reactor Regulation

NRC Current Review Status

- Issued DSER on June 16, 2003, with 174 Open Items
- Working to Resolve Open Items
  - Engaged Westinghouse (W) on 82 Open Items
  - Resolved 5 Open Items
  - Satisfied with W response to 31 Open Items (Confirmatory)
- Schedule for Final Safety Analysis Report (FSER)
  - NRC Issue FSER: September 2004
  - Reassessing Schedule

2

DSER Open Items

174 Open Items

- (as compared to over 1300 for AP600 DSER)

- Chapter 1 (Introduction) ------------ 3
- Chapter 2 (Site Envelope Char) -------- 6
- Chapter 3 (Structures, Comp., Equip.) --- 30
- Chapter 4 (Reactor) ---------------- 3
- Chapter 5 (Reactor Coolant System) ---- 3
- Chapter 6 (Engineered Safety Features) -- 9
- Chapter 7 (I & C) ------------------ 0
- Chapter 8 (Electric Power Systems) ----- 1
- Chapter 9 (Auxiliary Systems) --------- 7
- Chapter 10 (Steam and Power Conv.) ---- 3
- Chapter 11 (Radioactive Waste Man.) ---- 0
- Chapter 12 (Radiation Protection) ------ 0
- Chapter 13 (Conduct of Ops) ---------- 3
- Chapter 14 (Verification Progs) -------- 43
- Chapter 15 (Transient & Acc. Anal.) ----- 6
- Chapter 16 (Technical Specs) --------- 3
- Chapter 17 (Quality Assurance) -------- 5
- Chapter 18 (Human Factors) ---------- 7
- Chapter 19 (Severe Accidents) -------- 36
- Chapter 20 (Generic Issues) ---------- 2
- Chapter 21 (Testing & Comp Code Eval.) -- 4
- Chapter 22 (RTNSS) ---------------- 0
- Chapter 23 (Review by the ACRS) ------ 0
- Chapter 24 (Conclusions) ------------ 0

3

DSER Open Issues

- Supplemental DSER Sections
  - Chapter 21 – Testing and Computer Code Evaluation
  - Section 14.2 – Initial Test Program
  - Section 13.6 – Security
  - Section 3.6.3.4 – Leak-Before-Break
  - Section 3.3 – Wind and Tornado Loadings

4

DSER Open Issues (cont'd)

- *General* Open Items from DSER Chapter 1
  - DSER based upon Design Control Document (DCD) Revision 3...all revisions will be reviewed prior to FSER
  - Identification of Tier 2* information needs to be completed prior to FSER issuance
  - Identification and incorporation of combined license (COL) action items in FSER/DCD

5

DSER Open Issues (cont'd)

- Combined License (COL) Action Items
  - Many open items proposed new COL action items or change to existing COL action items
  - Additional items may be identified as reviews are completed
- Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)
  - Approximately 15 of the 35 items are open; remaining are resolved or confirmatory

6

DSER Open Issues (cont'd)

- Quality Assurance (QA)
  - QA Test Control Implementation Inspection at Oregon State University
  - Inspection of the Implementation of the Project-Specific Quality Plan at Westinghouse

7

DSER Open Issues (cont'd)

- Security
  - April & May 2003 – Interim Compensatory Measures (ICMs) and revised Design Basis Threat (DBT) provided to Westinghouse (W)
  - May 2003 – W revised Design Control Document (DCD) to defer Security Plan to COL Applicant
  - June 2003 – W letter provided assessment of the impact of ICMs and revised DBT to AP1000
  - Staff is reviewing DCD against 10 CFR Part 73, ICMs, and revised DBT for design implications that are not site specific

8

DSER Open Issues (cont'd)

- Leak-Before-Break (LBB)
  - Alloy 690/52/152 susceptibility to PWSCC
    - Limited Test Data and Operating Experience
    - Staff discussed with W the need for inspections and an understanding of sensitivity study margins to provide sufficient defense-in-depth to address uncertainty of PWSCC
  - Piping stress analysis for most limiting LBB systems
    - Staff is working to determine if the appropriate bounding limits are established using preliminary analysis results during the design certification phase
    - The information that the staff needs to make a safety conclusion regarding the preliminary analysis results has not yet been provided
    - Planning future meetings with W to address this issue

9

DSER Open Issues (cont'd)

- Sump Performance
  - Staff concerns regarding debris loading of IRWST screens, recirculation screens, and debris through reactor coolant system break
  - The staff audited the associated W calculation and identified assumptions of debris size, density, and porosity that are not consistent with industry practices

10

DSER Open Issues (cont'd)

- Structural / Seismic Design
  - The staff identified 38 structural/seismic items, many of which require audit of specific W calculations
  - Containment design was not completed at April 2003 audit

11

DSER Open Issues (cont'd)

- Liquid entrainment, long term cooling, core swell, and boron precipitation
  - Numerous discussion at ACRS Thermal Hydraulic Subcommittee meeting on July 16 & 17, 2003, provided a good technical exchange for the staff regarding these issues
  - Staff review will continue with independent analyses and review of W submittals

12

DSER Open Issues (cont'd)

- Probabilistic Risk Assessment (PRA)
  - January 23-24, 2003 - ACRS PRA Subcommittee Meeting
    - Raised ADS-4 Squib Valve reliability issue discussed yesterday
  - February 26, 2003 - PRA Meeting to discuss requests for additional information (RAIs) with W
  - PRA related open items: 24
  - Staff still reviewing W responses to the OIs

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AP1000 Summary

- Resolving DSER Open Items
- Questions?

14

AP1000 Draft Safety Evaluation Report Open Items Related to LBB

Presentation to ACRS

Pittsburgh, PA

Warren Bamford

AP1000 Piping Design

- **AP1000 will use piping Design Acceptance Criteria in lieu of detailed piping design and analysis**
  - Same approach as ABWR and System 80+
  - AP1000 piping configuration based largely on AP600
    - Line routings are the same
    - Some sizes changed
- **Final piping design and analysis is completed during COL stage**
- **Final piping design and analysis verified by ITAAC during construction**

AP1000 Draft Safety Evaluation Report

- **Two DSER Open Items Related to LBB**
  - 3.6.3.4-1
  - 3.6.3.4-2

- **PWSCC Open Item 3.6.3.4-1**
  - Requests W to include Combined Operating License applicant commitment to implement inspection plans, evaluation criteria, and other types of measures imposed on or adopted by operating PWRs with currently approved leak-before-break (LBB) applications as part of the resolution of concerns regarding the potential for PWSCC in those units
  - Westinghouse has incorporated the COL item in the AP1000 DCD

AP1000 Draft Safety Evaluation Report

- **Open Item 3.6.3.4-2**
  - Requests sensitivity studies be performed to address uncertainties related to PWSCC and the possible impact on LBB piping
    - Evaluate TGSCC crack morphology parameters as a surrogate for PWSCC and assess impacts on the LBB analyses

Westinghouse - NRC Recent Meeting

- Meeting held at NRC on 7-11-03
- Useful discussions held
- Each side presented ideas to resolve these issues
- Follow-up discussions planned
- Key issues will be discussed briefly here

Alloy 690, Alloy 52, Alloy 152 in AP1000

- In view of the continuing occurrence of primary water stress corrosion cracking [PWSCC] of Alloy 600, and its associated welds Alloys 82 and 182, the decision was taken to preclude use of these materials in the AP1000 design
- The materials selected for these applications are Alloys 690, 52 and 152, respectively
- The recent cracking experience in Alloy 600 and associated welds in operating PWRs therefore has no direct relevance to the AP1000

Alloy 690 - Historical Perspective

- Thermally treated Alloy 690 [A690 TT] was adopted as the preferred alloy for SG heat transfer tubing applications in 1986
- A690 TT also began service as mechanical SG tube plugs at approximately the same time
- Since the initial replacement SG startup at D.C. Cook Unit 2 in May 1989, A690 TT is now in service at more than fifty PWRs worldwide
- Applications of A690 TT have since been extended to include SG divider plates, pressurizer heater sleeve penetrations, RV head penetrations (including CRDM pipes), and other small-bore instrument penetrations

Alloy 690 - Experience (Cont'd.)

- Several of the CE-repaired components, with A690 TT as the replacement material, have been in service since approximately 1989
- With over fourteen years of SG operating experience, at temperatures exceeding 328°C [622.4°F], and nearly sixteen years in pressurizer penetration applications at 343°C [650°F] there has not been a single incidence of environmental degradation of A690 TT

Alloys 52 and 152

- With the extension of A690 TT applications to SG divider plates, RV and pressurizer penetrations, and other applications requiring welding, the A690 weld metal analogs Alloys 52 and 152 have been widely deployed
- Alloy 52 is used for gas-tungsten-arc [GTA] or gas-metal-arc [GMA] welding; Alloy 152 is the stick electrode composition used for shielded metal-arc welding [SMAW]
- Alloys 52 and 152 contain the same nominal concentrations of Cr and Fe, with slightly less Ni - relative to Alloy 690

A52 and A152 - Applications in PWRs

- The earliest application of these weld metal alloys was in CE pressurizers in which partial penetration welds were used to complete the repairs; these applications extend as far back as early 1989
- Westinghouse replacement SGs at N. Anna 1 and V. C. Summer were the first units to employ large-scale use of A52 and A152
- These SG applications included safe end-to-nozzle welds, and welding of the divider plate and stub runner to the channel head
- The initial SG applications went into service in late 1993, accruing nearly ten years of service since that time

Alloy 52 & Alloy 152 - SCC Resistance

- Owing primarily to high Cr content, Alloys 690, 52, and 152 exhibit apparent immunity to primary water stress corrosion cracking (PWSCC)
- Service experience with Alloy 690 in SG heat transfer tubing applications, and Alloys 52/152 as buttering, cladding and weld filler materials has been exemplary, with no reported degradation
- Laboratory testing of each of these materials endorse the exceptional corrosion resistance - no known incidence of crack initiation or crack propagation in primary water environments in any of these materials

Alloys 52 & 152 - SCC Resistance (Cont'd.)

- The laboratory tests of these weld metals continues to support the concept of "immunity" to PWSCC
- Even specimens precracked in fatigue will not propagate; details of these tests have been provided in the Revision 1 response to RAI 251.004
- Alloys 52 & 152 have been used in operating PWRs for RV nozzle repairs at V.C. Summer and Ringhals 3 & 4
- The use of Alloy 52 for an embedded flaw weld repair of CRDM pipe degradation at N. Anna Unit 1 was approved in late 1992, and generically approved in July 2003.

AP1000

Open Item 3.6.3.4-1 [PWSCC] - Conclusions

- Alloys 52 and 152 welds have been shown to exhibit excellent resistance to PWSCC, both in lab and field experience
- However, Westinghouse recognizes the reservations expressed by the NRC with respect to the limited [ca. 9.5 years] field experience
- Additional field experience - and laboratory evaluations currently underway - will accrue prior to final operation of AP1000
- Westinghouse remains confident this experience will validate the decision to extensively deploy these materials in the AP1000 primary system

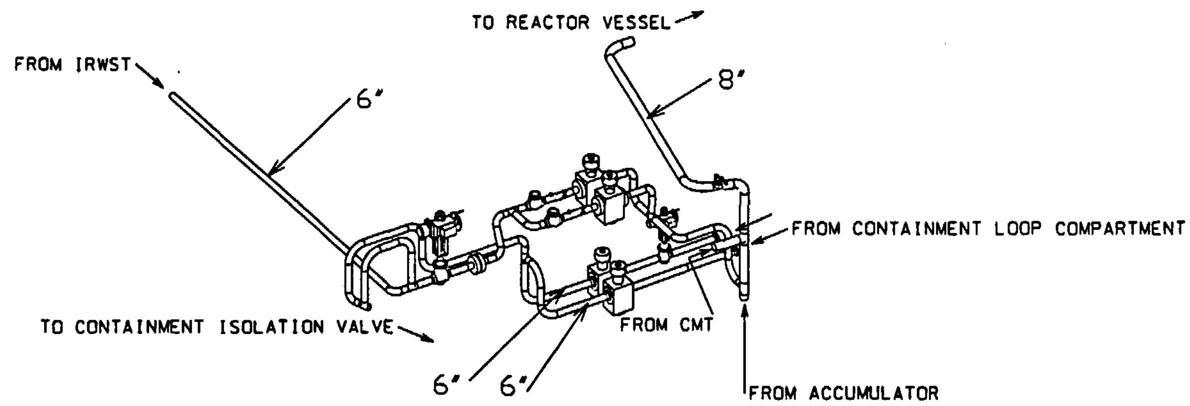
AP1000 Piping Systems Designed for LBB

- **AP1000 LBB Piping Systems are the same as those designed for AP600**
  - Some line sizes increased
  - Line routings the same
  - Stress analyses completed for AP600 demonstrate the feasibility that the AP1000 piping systems can be designed to meet bounding analysis curves

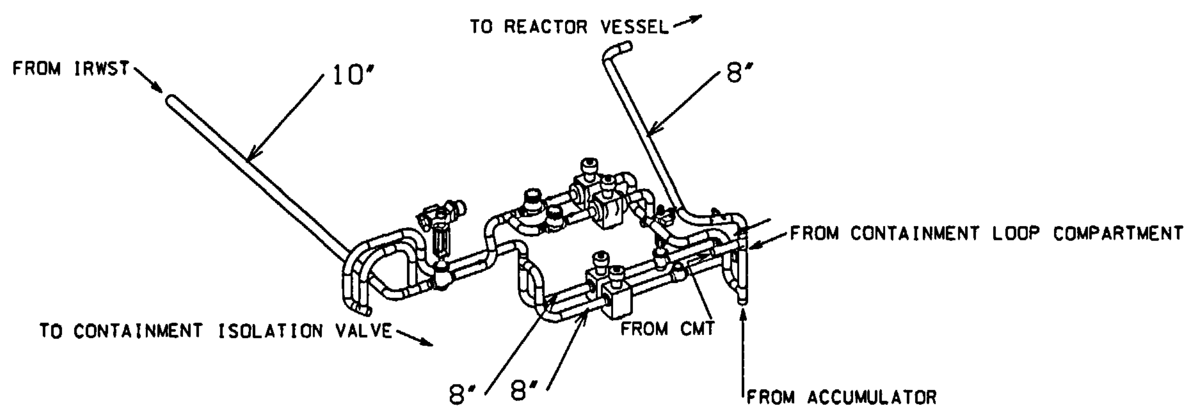
AP1000 Piping Systems Designed for LBB

- Reactor Coolant Loop
- Pressurizer Surge Line
- Direct Vessel Injection Lines A & B
- Core Makeup Tank Inlet Lines A & B
- Passive RHR HX Return Lines
- ADS-1/2/3 Piping
- ADS-4 Piping A & B
- Normal RHR Piping
- Main Steam Lines A & B

Comparison of IRWST Injection/DVI Line



DVIA-AP600



DVIA-1000

AP1000 LBB Analysis Method

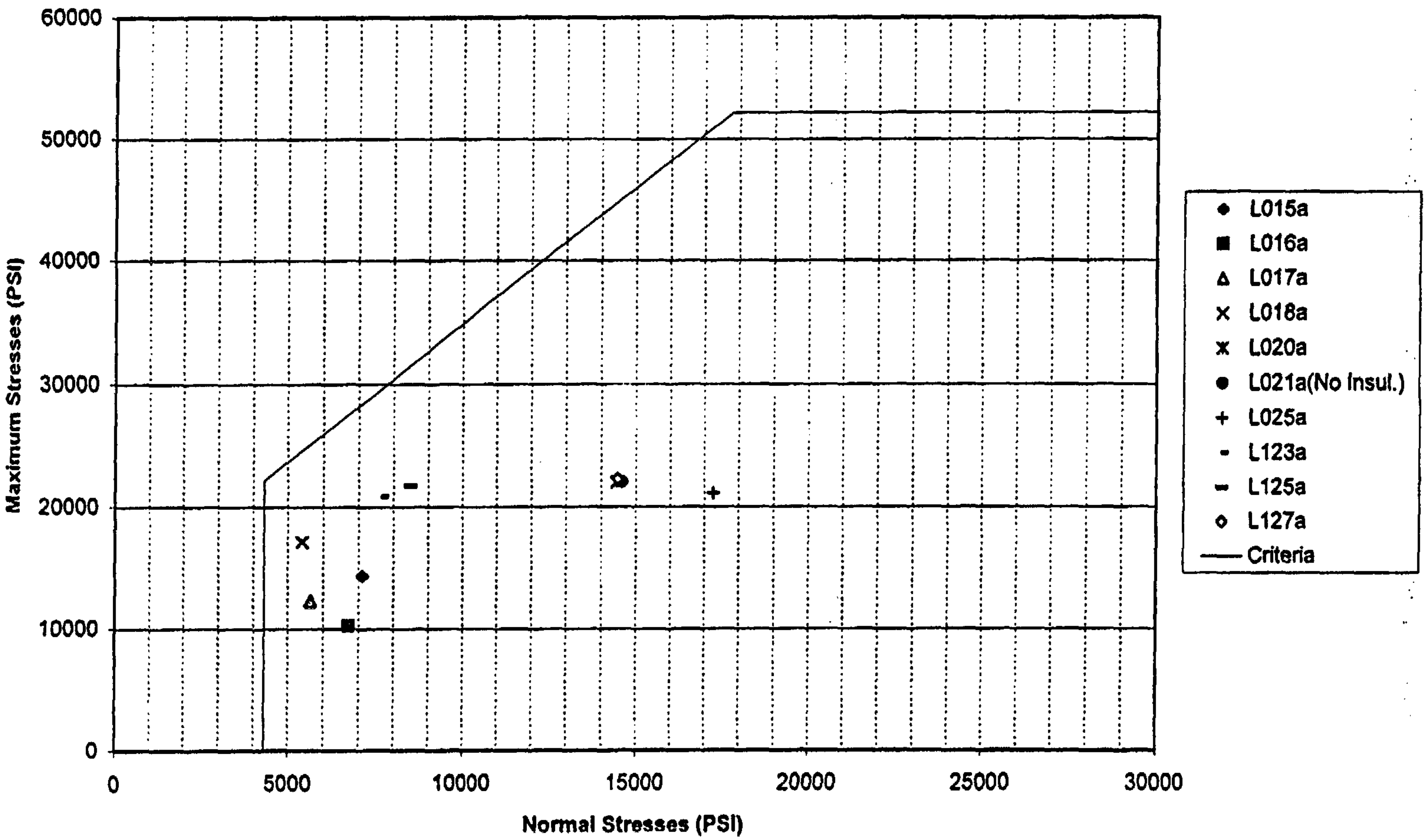
- **Leak-Before-Break Bounding Analysis Methods**
  - Develop Bounding Analysis Curves based on pipe material and pipe size
  - Bounding Analysis Curve Margins
    - Margin of 10 on leak detection capability
      - Margin of 2 on flaw size
      - Margin of 1 on load by using absolute summation method of maximum loads combination
  - Consistent with AP1000 DCD Appendix 3B
- **These methods and criteria were reviewed by NRC staff during an audit in Westinghouse in September 2002**

AP1000 Preliminary Stress Analysis

- **To resolve this issue, Westinghouse has proposed to complete a Preliminary piping stress analysis for NRC review**
- **DVI-A Piping Analysis Package**
  - Selected based on our experience with AP600
    - Difficult to qualify
  - Complicated piping system
  - Some piping sizes were changed
  - Contains smallest piping line qualified for LBB
  - Subcompartment pressurization impacts if line would not meet LBB criteria

Preliminary Results: An Example

Figure 8.6.1 AP1000 Bounding Analysis Curve for 8" CMT, DVI,IRWST
(Line Numbers: L015A,016A,018A,020A,021A-No Insul.,025A,125A,127A)



Status of Discussions with NRC on LBB

- AP1000 Piping systems are very similar to AP600, which has been approved
- Evaluation of one AP1000 LBB piping system is currently in progress
- Discussions continue on the best way to ensure that Alloy 690, and Alloy 52 and 152 welds will be immune from SCC throughout the service lifetime of an AP1000