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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

1 ALSO PRESENT:
2 MEDHAT EL-ZEFTAWY
3 MIKE CORLETTI
4 TERRY SCHULZ
5 ED CUMMINS
6 TOM HAYES
7 DAN FREDERICK
8 RALPH CARUSO
9 JIM SCOBEL
10 SELIM SANCAKTAR
11 JUN LI
12 JIM GRESHAM
13 M. KHATIB-RAHBAR
14 MIKE ZAVISCA
15 SUD BASU
16 H ESMAILI
17 JOELLE STAREFOS
18 RICHARD ORR
19 JOHN SEGALA
20 RON VIJUK
21 TIM ANDREYCHECK
22 JIM GROVER
23 WARREN BAMFORD
24 BOB FULD
25

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

8:35 a.m.

1
2
3 CHAIRMAN KRESS: This is the second day of
4 the Advanced Reactor Subcommittee meeting. I don't
5 have any introductory comments, so we are starting
6 with the DSER open items and I guess the Staff is
7 leading off.

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

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

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

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

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

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

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1 CHAIRMAN KRESS: That is all.

2 MS. STAREFOS: The entire --

3 MEMBER WALLIS: That is the whole thing?

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

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

12 We have engaged Westinghouse on 82 of the
13 174 open items. We have resolved 5 of the open items,
14 and we are satisfied with Westinghouse's responses on
15 31 of the open items. Those have now been considered
16 confirmatory.

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

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

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1 are in the process of reassessing the schedule.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

7 (Laughter.)

8 MS. STAREFOS: I do address that.

9 MR. CUMMINS: We are trying to get better.

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

12 (Laughter.)

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

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

25 So you will see that there is a pretty

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

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

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

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

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

25 MS. STAREFOS: No, that is one of the

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

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

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

15 MS. STAREFOS: Yes, prior to the FSER.

16 MEMBER LEITCH: Yes, right.

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

22 MEMBER LEITCH: Okay, thanks.

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

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1 valve reliability.

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

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

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

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

15 CHAIRMAN KRESS: A COL action item?

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

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

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

23 CHAIRMAN KRESS: As part of the FSER?

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

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

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

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

13 CHAIRMAN KRESS: Okay, thank you.

14 MS. STAREFOS: You are welcome.

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

21 MS. STAREFOS: That is correct.

22 MEMBER LEITCH: Does Chapter 14
23 differentiate between those two?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

25 We also have a similar process in part 52

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

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

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

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

22 So it is something that we need to focus
23 on.

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

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

5 MS. STAREFOS: Not necessarily. The tier
6 2 star is information that the applicant has
7 identified in their DCD. So when they present that to
8 us they said, this is stuff that we feel strongly
9 about we are not going to change.

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

12 MR. CUMMINS: Yes, it really was -- on
13 AP600, at the end of the licensing on AP600, the Staff
14 and Westinghouse sat down and went through the whole
15 DCD, and the FSAR, for what are the most important
16 things that we don't want you to make a change with a
17 50.59 process, that you have to come back to us.

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

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

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

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

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

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

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

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

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

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

9 MS. STAREFOS: I'm sorry?

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

12 MS. STAREFOS: Okay, yes.

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

16 MS. STAREFOS: Yes, sir.

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

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

21 MEMBER WALLIS: Do I have the DCD
22 somewhere?

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

24 MEMBER WALLIS: Maybe you should do that
25 today.

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

3 MEMBER WALLIS: That is somewhere else?

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

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

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

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

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

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

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

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

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

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

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

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

22 Is that really the way it works?

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

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

3 And they come and look at it --

4 MEMBER SIEBER: Which is more often the
5 case.

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

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

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

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

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

20 CHAIRMAN KRESS: Coordinate through MED

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

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

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

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1 to the next.

2 MR. CORLETTI: Link these CDs, you click
3 on the open item and it takes you to the next -- we
4 did that for Dana Powers, we gave him a link that was
5 30 boxes of stuff that was all linked. That requires
6 some upfront work. I don't have it right now, but we
7 can --

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

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

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

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

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

25 MR. ZAVISCA: Let me ask, for tier 1

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1 information, is that part of the ACR subcooled?

2 MS. STAREFOS: I am not sure --

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

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

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

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

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

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

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1 completed.

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

5 And that brings me into the combined
6 license items. There are numerous combined license
7 action items, open items I should say, in this DSER,
8 18 to be specific.

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

13 Another area where we had a numerous
14 amount of open items was the ITAAC, the inspection,
15 test, analysis and acceptance criteria. There are,
16 approximately, 35 -- well, there are 35, approximately
17 15 of those are still open.

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

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

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1 State University on the AP1000 facility.

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

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

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

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

25 Is that true? I'm talking about the

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1 active systems.

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

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

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

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

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

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

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

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

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

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

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

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

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1 MR. CORLETTI: Yes.

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

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

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

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

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

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

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

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1 identified them as our systems that have availability
2 controls.

3 MEMBER LEITCH: Thanks a lot.

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

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

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

15 MEMBER LEITCH: Okay, thanks.

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

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

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

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1 design basis threat to Westinghouse for their
2 consideration.

3 In May of 2003 we met with them to discuss
4 the information that we had provided, and later in May
5 2003 Westinghouse revised their design control
6 document to defer their security plan to the COL
7 applicant.

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

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

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

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

25 MEMBER WALLIS: That is likely to be a

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

3 MR. CUMMINS: Yes.

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

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

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

12 MR. CUMMINS: It is not on either the
13 ICMS, or the design basis --

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

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

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

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

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

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

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

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

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

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

25 The next one is sump performance. We have

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

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

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

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

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

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

25 MR. CORLETTI: We had a couple of

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

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

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

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

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

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

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

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

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

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

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

13 MEMBER WALLIS: What do they do, though?

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

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

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

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

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

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

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

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

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

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

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

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1 yesterday.

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

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

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

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

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

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

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

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

9 MR. CORLETTI: I have a slide on that.

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

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

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

25 Do they do independent analysis in order

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

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

9 We did not perform independent
10 confirmatory analysis.

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

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

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

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

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

25 MR. CHENG: Yes.

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1 CHAIRMAN KRESS: Can we get copies of
2 those?

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

5 CHAIRMAN KRESS: Yes.

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

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

11 MS. STAREFOS: Thank you.

12 CHAIRMAN KRESS: Thank you.

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

15 MR. CHENG: Thank you.

16 MS. STAREFOS: Are there any further
17 questions?

18 (No response.)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1 site -- set of site meteorological information.

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

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

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

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

12 MR. GROVER: Yes, and limitations on
13 assumptions.

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

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

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

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

3 Perhaps I'm mistaken, but --

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

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

12 MR. SEGALA: We do have a COL.

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

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

25 So we felt that we have a very good, by

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

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

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

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

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

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

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

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

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

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

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

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

25 And it turns out that after 72 hours the

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

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

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

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

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

22 MR. CORLETTI: We have big bottles.

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

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

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

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

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

25 MR. CUMMINS: Yes, one other comment that

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

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

8 MR. CUMMINS: Exactly.

9 MEMBER SIEBER: As opposed to individual
10 signal wire?

11 MR. CUMMINS: Yes.

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

18 The interface computers aren't in the
19 control room.

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

24 MR. CUMMINS: Yes.

25 MEMBER SIEBER: And interpret what that

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

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

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

7 MR. CORLETTI: The soon to be revised
8 10CFR50.44, which essentially allows for some
9 relaxation of the QA on some of the hydrogen
10 recombiners equipment, like the hydrogen -- I think we
11 were expecting this to be approved, I think, last
12 year.

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

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

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

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1 regulation passes, but we will deal with it.

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

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

9 MEMBER SIEBER: You do provide igniters in
10 the --

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

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

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

18 MEMBER SIEBER: Right, okay.

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

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

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

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

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

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

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

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

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

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

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

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

16 MEMBER WALLIS: That makes sense.

17 MR. CORLETTI: Not because it was AP600.

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

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

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

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

3 MR. CORLETTI: Sure.

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

6 MR. CORLETTI: On the containment shield
7 building?

8 MEMBER SIEBER: Yes.

9 MR. CORLETTI: It is three feet.

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

12 MR. CORLETTI: Two feet.

13 MEMBER SIEBER: Two feet.

14 MR. CUMMINS: It is a pretty massive
15 structure.

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

20 MR. CORLETTI: Yes.

21 MEMBER SIEBER: With a lot of flow?

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

24 MEMBER SIEBER: And yet you did it again.

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

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

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

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

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

11 MR. CUMMINS: Yes, we do.

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

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

19 (Laughter.)

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

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

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

4 MR. CORLETTI: Well, of 174 questions,
5 there were probably, of that, about -- there is a
6 number of about 80 or 90 were kind of new items. And
7 80 were items that actually we knew about, and have
8 already provided the answers in April.

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

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

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

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

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

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

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

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

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

25 So it will take time for us to understand

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

3 MR. CORLETTI: Yes.

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

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

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

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

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

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

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

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

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

16 (Laughter.)

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

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

23 MEMBER RANSOM: Oh, those are reactors?

24 MR. CORLETTI: Those are operating --

25 MEMBER RANSOM: Now I understand.

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1 (Everyone speaks at the same time.)

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

4 MEMBER SIEBER: I just wondered if you --

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

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

10 MEMBER SIEBER: The AP600 is 12 foot fuel?

11 MR. CORLETTI: Twelve foot fuel --

12 MEMBER SIEBER: Like your current plant?

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

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

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

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

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

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1 would imagine.

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

4 MEMBER SIEBER: Yes, it is.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

25 So the next -- I think the response that

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

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

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

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

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

25 So I will just explain why I think it is

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

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

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

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

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

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

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

11 I think that is all I have to say.

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

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

16 MS. STARRETT: Okay.

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

21 MS. STARRETT: Okay.

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

24 CHAIRMAN KRESS: When will this public
25 forum be?

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

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

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

9 MEMBER WALLIS: But not make specific
10 examples?

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

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

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

23 MR. CORLETTI: Sure.

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

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

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

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

11 MEMBER SIEBER: Thank you.

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

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

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

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

23 I was involved in leak report break in the
24 original presentations to you folks back in 1983 and
25 '84, when we --

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1 CHAIRMAN KRESS: I don't remember that.

2 MR. BAMFORD: -- concept of --

3 CHAIRMAN KRESS: I don't remember that.

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

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

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

17 MEMBER WALLIS: Which pipes are you
18 talking about?

19 MR. BAMFORD: I'm sorry?

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

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

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

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

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

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

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

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

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

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

14 MEMBER FORD: How does --

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

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

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

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

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

7 MR. BAMFORD: Right.

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

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

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

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

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1 can deal with.

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

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

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

13 (Phone interruption.)

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

16 There is a -- oops.

17 (Phone interruption.)

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

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

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

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

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

12 MR. CUMMINS: I think that we multiply and
13 you can tell me here, we multiply it by ten, right?
14 That is in his equation he assumes a safety factor of
15 10 for leakage.

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

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

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

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

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

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

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

22 MR. CUMMINS: Yes.

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

25 MR. BAMFORD: All right, let me go on

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

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

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

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

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

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

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

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

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

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

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

25 So there are programs around that are

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

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

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

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

14 MR. BAMFORD: Well, it is important to
15 mention that the materials that we have in the AP1000
16 are all very ductile, stainless steel, and the alloy
17 690, and 182 materials are all extremely ductile to
18 fracture.

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

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

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

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

7 And because of that we have decided not to
8 use those materials in AP1000, and also AP600. And
9 what we have gone through is alloy 690, and 52, and
10 152, which are -- I will describe in a little bit the
11 differences.

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

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

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

25 However, it does bring up the question,

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

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

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

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

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

1 penetrations have -- are being replaced with 690.

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

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

10 MEMBER SIEBER: Thank you.

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

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

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

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

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

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

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

10 MEMBER FORD: With 52, 152 welds?

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

14 MEMBER SIEBER: The main piping --

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

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

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

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

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

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

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

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

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

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

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

23 MR. FULD: You mean the CRDM?

24 MEMBER FORD: Correct.

25 MR. BAMFORD: Yes, the biggest

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

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

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

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

25 MEMBER FORD: Maybe I'm jumping onto what

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

4 MR. BAMFORD: Well, we know that the
5 weldability of 52 and 152 is not as good as it is for
6 82 and 182. And some of the cases where we have had
7 big repairs that have been made, the exposed surface
8 has been -- I will talk about the VC Summer repair,
9 for example.

10 The exposed surface to the water was 52
11 material, but the bulk of the weld was filled with
12 192, either 82 or 182, I'm not sure. It was probably
13 82, the automatic weld equivalent.

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

20 And work is going on in that area.

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

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

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

4 MR. FULD: We ran into quite a learning
5 curve with both in Pensacola and -- with the use of
6 the 52, even for a -- to the point where, for example,
7 when Sema replaced the spanish units, they used
8 82/180. They just wanted to avoid the issue.

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

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

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

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

1 list of things that the Staff are looking at?

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

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

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

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

19 MS. STAREFOS: Let's ask Joe Sebrosky.

20 MEMBER FORD: I guess Joe is not there.

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

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

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

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

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

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

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

17 MR. BAMFORD: You mean 52?

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

22 MS. STAREFOS: Thank you, Barry.

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

1 resistance of 52 and 152.

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

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

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

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

21 We also used an overlay technique for a
22 repair of the CRDM tube degradation at North Anna unit
23 1, and that was approved in -- I don't think it is
24 2002, not 1992, that is a correction.

25 And that repair, which we called the

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

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

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

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

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

25 However, those particular types of alloys

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

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

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

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

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

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1 question, and we should pursue that.

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

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

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

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

18 MR. FULD: Yes.

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

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

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

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

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

13 MEMBER FORD: Well, my next question --

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

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

22 (Everyone speaks at the same time.)

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

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

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

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

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

14 MEMBER FORD: Yes.

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

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

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

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

25 MR. BAMFORD: Well, I think the answer is

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

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

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

9 MR. FULD: Yes.

10 MEMBER SIEBER: What is it?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

23 Like the one line here is -- went from 6
24 to 10. This one line to the reactor vessel stayed at
25 8 inches. So there are some changes, but you can look

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

10 So that was another reason for choosing
11 that.

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

16 MR. CORLETTI: Yes.

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

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

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

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

1 before break.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

6 And it just represents itself as
7 condensation.

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

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

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

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

23 MEMBER SIEBER: Will the tech specs
24 address that?

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

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

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

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

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

15 MEMBER SIEBER: That means shutdown.

16 MR. CORLETTI: Well, maybe.

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

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

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

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1 such --

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

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

8 MEMBER SIEBER: I can compare it.

9 MR. CORLETTI: Yes, sure.

10 MEMBER SIEBER: I will compare that
11 tonight.

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

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

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

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

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

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

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

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

7 MS. STAREFOS: That is the official
8 version.

9 MEMBER SIEBER: What version is that?
10 (Everyone speaks at the same time.)

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

14 (Laughter.)

15 MEMBER SIEBER: Thank you.

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

21 The evaluation of one AP1000 system is
22 currently in progress, and I showed you an example of
23 some of the results there. Discussions continue as to
24 the best way to ensure that alloy 690, and 52, and
25 152, will be immune throughout the service lifetime of

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1 AP1000.

2 Any questions that you didn't already ask?

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

6 MR. CORLETTI: That is not correct. That
7 is t minus 6-10. And operating plants are up to about
8 6-30. They did have an AP600 with 600.

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

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

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

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

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

25 The AP1000 has -- takes longer to get into

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

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

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

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

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

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

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

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

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

16 MR. SCHULZ: That is correct.

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

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

25 Now, we've carefully routed those lines

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

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

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

13 MEMBER SIEBER: Well, it is colder than
14 containment.

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

17 MEMBER SIEBER: -- condensation --

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

21 MEMBER SIEBER: Some do.

22 MR. ANDREYCHECK: Some do, not all. But -
23 -

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

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

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

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

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

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

24 (Everyone speaks at the same time.)

25 MR. ANDREYCHECK: -- like you put in your

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

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

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

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

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

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

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

25 MR. CARUSO: And that is going to apply to

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

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

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

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

20 Because if it becomes detached, it is
21 okay.

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

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

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

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

18 MR. SCHULZ: Yes.

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

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

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

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

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

13 MR. SCHULZ: They do connect, though.

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

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

25 MEMBER WALLIS: Then there is the screen

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

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

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

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

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

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

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

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

1 is actually the operating deck, correct?

2 MR. CUMMINS: Yes.

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

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

10 MEMBER SIEBER: And do they connect?

11 MR. CUMMINS: Yes.

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

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

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

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

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

25 MR. SCHULZ: And it goes to a four inch

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

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

5 MR. SCHULZ: I don't think so.

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

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

12 MEMBER WALLIS: Well, both.

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

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

17 (Everyone speaks at the same time.)

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

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

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

25 MR. CUMMINS: The paint in the containment

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

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

10 So the organic zinc paint pool is going to
11 be bubbling, and probably lifting stuff up by the
12 buoyancy of the bubbles attached to the paint, and it
13 is not going to be just a static stuff laying on the
14 bottom of the IRWST.

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

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

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

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

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

3 MEMBER WALLIS: Well, it does on some --

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

6 (Everyone speaks at the same time.)

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

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

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

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

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

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

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

24 MEMBER WALLIS: It is floating down into
25 the IRWST.

1 (Everyone speaks at the same time.)

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

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

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

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

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

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

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

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

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

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

5 MEMBER SIEBER: It is painted before it
6 gets there.

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

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

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

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

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

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

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

8 (Everyone speaks at the same time.)

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

13 MEMBER SIEBER: Like your modular
14 sandwich?

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

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

20 MR. CUMMINS: No.

21 MEMBER SIEBER: For a number of reasons.

22 MR. SCHULZ: Not on the containment.

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

1 the fibrous material out of containment.

2 MR. SCHULZ: Right.

3 MEMBER SIEBER: Thank you.

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

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

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

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

25 Does this mean that you are not going to

1 let licensees prestage material for refueling outages?

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

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

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

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

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

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

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

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

9 MR. SCHULZ: That is true for any --

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

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

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

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

18 MR. CARUSO: Is that documented someplace?

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

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

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1 But that is just a couple of units.

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

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

9 MEMBER SIEBER: And you have to account
10 for everything.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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1 injection from the IRWST has to go through that
2 screen.

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

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

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

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

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1 pressure drop.

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

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

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

21 MR. CUMMINS: Bill Brown's curve was for
22 IRWST injection.

23 MEMBER WALLIS: Yes, that is what this is.

24 MR. SCHULZ: Well, the top one, which is
25 much minor impact --

1 (Everyone speaks at the same time.)

2 MR. SCHULZ: Mine included both of these
3 effects actually simultaneously. In my analysis. So
4 from the plant analysis that I did, it included that.

5 CHAIRMAN KRESS: How do you calculate this
6 BP, do you take a given thickness of this stuff, and
7 see how much area it blocks off for that thickness,
8 and the rest of the area is what is left for the flow?

9 MR. SCHULZ: Yes, you basically -- you go
10 through a process that, again, is documented in this
11 NUREG, and it is related to the amount of material you
12 put on.

13 So we relate the 500 pounds, we split it
14 50 percent fiber, we put it onto one or two screens,
15 depending on where we are analyzing, and that builds
16 up a thickness. Then you consider putting particles
17 in there, and the flow of DP, and that can compress
18 the bed, and which then allows for, say, less
19 porosity, less holes through the debris.

20 CHAIRMAN KRESS: So you put that much
21 weight over the whole surface area?

22 MR. CUMMINS: That is correct.

23 CHAIRMAN KRESS: And that fixes your
24 thickness, then?

25 MR. CUMMINS: Yes.

1 CHAIRMAN KRESS: And then because you know
2 the density of the stuff?

3 MR. CUMMINS: That is correct.

4 CHAIRMAN KRESS: And then you compress it
5 a little bit, so you've got a different density.

6 MR. CUMMINS: What causes the compression
7 is the flow --

8 CHAIRMAN KRESS: And then you have a
9 correlation, somewhere, for DP versus this thickness,
10 as compressed, and that comes out of -- somebody
11 measured that somewhere, did they?

12 (Everyone speaks at the same time.)

13 CHAIRMAN KRESS: That was a Los Alamos
14 paper?

15 MR. ANDREYCHECK: Yes, NUREG 6224 has a
16 good basis for it, and so flat screen, flat plate type
17 pressure drop. And the -- it is generally considered
18 conservatism. If you normally apply the fiber across
19 the screen, and then apply the particulates uniformly
20 on that, anything that is non-uniform tends to give
21 you a smaller head loss across the screen.

22 MEMBER WALLIS: We have very little idea
23 what this resident debris is.

24 MR. ANDREYCHECK: And there is a current
25 program in place, and I worked in Los Alamos, and the

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1 NRC, to try to determine that. Five plants have
2 agreed to provide samples of resident debris.

3 MEMBER WALLIS: All you need to do is
4 vacuum the containment a few times.

5 MR. ANDREYCHECK: Actually, there are two
6 types that actually wipe out, do a power wash of the
7 containment, and they use it primarily for purpose of
8 decontamination, but they get an amazingly clean
9 containment. There are two plants that I'm aware that
10 do that. I think there are several others. But that
11 is a good point.

12 As part of their containment close out,
13 just before they go back up to power.

14 MR. SCHULZ: The final evaluation we did
15 was considering some debris getting into the RCS and
16 bypassing the screen. And again this is -- this would
17 have to be some neutrally buoyant fibers, which is
18 what we assumed for the other two cases.

19 And we split these 500 pounds of debris,
20 again, 50 percent fiber, but it would be into sort of
21 integrated flow rates for several hours, we get about
22 40 percent going through the recirc screens, and about
23 60 percent going through the break.

24 And so we took 60 percent of the debris,
25 and put it in the reactor, and build up a bit inside

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1 the --

2 CHAIRMAN KRESS: Once again using the same
3 process?

4 MR. SCHULZ: Same process, how thick the
5 bed is, and what the flow rate -- now, of course the
6 flow rate here is the total flow rate from the break,
7 and from the screens, and DVI lines, and get about a
8 one psi pressure drop. The area in the core is not as
9 big as the screens.

10 Now, in this time frame with this flow
11 rate, is shortly after recirculation begins, so the
12 flow rates are still fairly high. This is about the
13 maximum recirc flow rate that we have seen.

14 Now we relate the downcomer densities that
15 we have to about 29 inches a head extra that we would
16 need, to overcome this BP that we added to the core.
17 And what I looked at was the WCOBRA/TRAC long term
18 cooling analysis, which showed that the water level
19 was more than twice that below the DVI connection.

20 So that by backing it up some, basically,
21 you were not imposing any increase in the injection
22 pressure. If you backed up the water to at or above
23 the DVI connection, now the DVI connection would see
24 some additional back pressure.

25 CHAIRMAN KRESS: What if you put that

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1 debris, if you put it on different areas of the core?

2 MR. SCHULZ: We looked at two different
3 cases.

4 CHAIRMAN KRESS: So that you blocked up
5 just part of the core, and what will that do to that
6 set of fuel channels that is blocked.

7 MR. SCHULZ: Ken has some analyses that
8 they have done on operating plants. It wouldn't
9 completely block it. Again, this is porous. So water
10 would still get --

11 CHAIRMAN KRESS: -- cross flow --

12 MR. SCHULZ: And that is the other point
13 that Tim was going to talk about, where they actually
14 looked at the cooling --

15 MEMBER LEITCH: -- containment --

16 MR. ANDREYCHECK: We looked at blocking
17 the bottom of the core for 3,400 megawatt for PWR, and
18 we did parametric studies looking at 20, 40, 60, and
19 80 percent blockage.

20 And we started assuming the blockage in
21 the center of the core had worked out radially, so we
22 were getting water around the periphery. Having to
23 get to the hot channels and the center of the core.

24 We were able to demonstrate, analytically,
25 that we would get sufficient amount of cross flow,

1 through the channels, that with 80 percent blockage we
2 would be several hundred degrees away from fuel clad
3 damage.

4 MEMBER WALLIS: -- self correcting in the
5 hot channel, and that means the hydrostatic head goes
6 sideways?

7 MR. ANDREYCHECK: But we did get added
8 water flow from the periphery, into the center of the
9 hot channel, and provide adequate cooling for clad
10 damage.

11 MEMBER WALLIS: So this 500 pounds seems
12 just a number that came from somewhere?

13 MR. ANDREYCHECK: It came from the NRC
14 study for GSI-191 --

15 MEMBER WALLIS: It seems somewhat
16 unrealistic.

17 MR. ANDREYCHECK: That number was based on
18 scaling from PWR sump screen blockage issues, based on
19 surface area of PWR containment versus --

20 MEMBER WALLIS: So is 500 pounds of debris
21 being likely? There is no evidence of 500 pounds
22 being likely?

23 MR. ANDREYCHECK: No, there is none. In
24 fact, the NRC's study looked at scaling and said that
25 the range that they would get from the surface areas

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1 of PWR and BWR containments was between 100 and 500
2 pounds.

3 We chose 500 pounds as a maximum amount,
4 and typically we would not expect to see that amount.
5 And this was, again, particulate and fibrous debris.

6 MR. SCHULZ: The last couple of slides
7 talk about the coating failure, and some settling
8 calculations that we have done.

9 Again, we don't expect the coatings to
10 fail, because we are putting in qualified coatings.
11 But we think we can't tolerate the failure of the
12 coatings primarily because of the requirement that
13 they be of high density.

14 MEMBER WALLIS: Now, these are coatings?
15 How about rust?

16 MR. SCHULZ: There should not be any rust.

17 MEMBER WALLIS: Rust on your water lines.

18 MR. SCHULZ: The water lines are
19 insulated, and they would be -- they would have a
20 coating on them. The rust also, I would think, would
21 be heavy, would settle.

22 Again, the characteristics of the --

23 MEMBER WALLIS: Well, there is rust on the
24 reactor vessel, there is rust on quite a few things.

25 MR. SCHULZ: Not really rust, no, oxide.

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1 MEMBER WALLIS: Well, oxide is rust.

2 MR. SCHULZ: It is not like, you know, --
3 it is a thin film that, I think, would also be high
4 density.

5 MR. ANDREYCHECK: If you are looking at a
6 parallel between the migration of corrosion, in the
7 PWR sense, and BWR issues, with what we have in the
8 AP1000, there was a high velocities in the taurus and
9 the suppression pools that tended to migrate and move.

10 And there is also very energetic steam
11 bubble collapsing that tended to stir pools up, that
12 would move and make transportable the corrosion
13 products, which have a tendency to sit on the bottom
14 of the pool.

15 MEMBER WALLIS: I understand there is
16 quite a lot down there.

17 MR. ANDREYCHECK: It could be, I'm not
18 familiar with -- but the -- for the AP1000 as pointed
19 out by Terry, the velocities, even in the pools, tends
20 to be fairly low. And products that have a tendency
21 to have higher specific gravities, and the 100 pounds
22 per cubic feet of coating density gives us a specific
23 gravity of approximately 1.3. And iron oxide is above
24 that, as I recall.

25 So the tendency would be for those

1 products to settle out. We chose very light density
2 products to do these analyses, even the fiber and the
3 particulates. Everything that you are running up, in
4 the way of other products, corrosion and also
5 galvanized products that might be subjected, would
6 have a tendency to have a higher specific gravity, and
7 would have a tendency to settle in this particular
8 kind of environment that we are talking about, very
9 low velocity, throughout the entire region of the
10 AP1000.

11 You see, here --

12 MEMBER WALLIS: Davis Besse was a PWR.

13 MR. ANDREYCHECK: Davis Besse is a B&W
14 design --

15 MEMBER WALLIS: And they had 900 pounds of
16 solid material on top of the head, or something like
17 that? There are ways in which you can build up
18 corrosion product, and other things in the
19 containment, if you don't pay attention.

20 MR. ANDREYCHECK: You are correct, if you
21 don't pay attention. And, in fact, they had other
22 things staged inside containment, like power washing
23 equipment, to clean off their fan coolers, which
24 tended to clog with boric acid.

25 MR. CARUSO: What drives this is they

1 can't afford to shut down an extra day in order for
2 refueling. They are trying to cut down on refueling
3 times.

4 MR. SCHULZ: We have addressed that by
5 providing a special area, just outside the
6 containment, and very easy access in the containment,
7 so that they only have -- the problem is getting stuff
8 into containment, like they do today.

9 CHAIRMAN KRESS: I hate to cut this short

10 MR. CARUSO: The plant I remember most
11 vividly is Connecticut Yankee. It is gone now, but
12 they had built cages inside the containment, that held
13 all of the supplies that they would need during
14 refuelings and they had these enormous metal cages
15 built inside containment, that held rolls of
16 polyethylene, and staging, and welding supplies.

17 And then there were piles of wood for
18 scaffolding all over the place.

19 MR. ANDREYCHECK: I'm not disagreeing with
20 you, but I think the issue that NRC has brought to
21 light is making utilities to take a look at what they
22 are doing.

23 Your point is well taken, that wasn't --
24 that was the way things were done in the past, I'm
25 not going to disagree with you on that. But I think

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1 that if you are looking at across the board, as Terry
2 mentioned, for AP1000 is addressed by the staging area
3 outside --

4 CHAIRMAN KRESS: I think all of this is
5 not part of design cert review, this is an issue, or
6 a set of issues which are the review of the
7 cleanliness program of the COL applicant.

8 MEMBER SIEBER: Do you have an equipment
9 hatch in the AP1000?

10 MR. ANDREYCHECK: We have two, sixteen
11 foot --

12 MEMBER SIEBER: Where are they? I mean,
13 do they open up into a building, or do they open up to
14 the blue sky?

15 MR. ANDREYCHECK: Into the annex building,
16 this is what Terry was talking about.

17 MEMBER SIEBER: Both of them?

18 MR. ANDREYCHECK: Both of them do.

19 MEMBER SIEBER: If you were going to
20 change a steam generator, which I'm sure you don't
21 anticipate --

22 MR. ANDREYCHECK: The steam generator is
23 too large to get through the equipment hatch, and the
24 method of removal is to lift it with a polar crane,
25 and then lift it up the top of the center of the

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1 exhaust, if you will, of the PTS. We cut the steel
2 containment. There is no structural concrete there,
3 and lift it up through the top.

4 CHAIRMAN KRESS: I hate to cut this off,
5 I think we are running short on time. Let's see the
6 figures.

7 MEMBER WALLIS: The higher flow takes the
8 debris close to the screen, presumably.

9 MR. SCHULZ: What this means is that --
10 no, they are not reversed, it is a communication issue
11 here. In the case one we assume higher flow coming
12 from the front of the screen, and lower flow coming
13 from the side.

14 In the case two it was a different
15 scenario where we assumed uniform flow out at the edge
16 of the screen, coming from both the front and the
17 side. So when it says higher flow, it means higher
18 flow approaching the front of the screen, which is the
19 side of the screen.

20 So it is conservative, the cases one is
21 showing you the approach from 10 foot away, from the
22 front of the screen. The plate extends out seven foot
23 to the one side.

24 MEMBER WALLIS: So this is the sump size
25 particle, and there is only one particle that is going

1 to take that trajectory?

2 MR. SCHULZ: Yes.

3 MEMBER WALLIS: And there is a whole
4 distribution of particles?

5 MR. SCHULZ: And densities, right.

6 MEMBER WALLIS: So it doesn't really give
7 the picture very well.

8 MR. SCHULZ: It depends on what picture
9 you are trying to show, right.

10 MEMBER WALLIS: Well, I mean, another one
11 is to the screen, the big ones fall down.

12 MR. SCHULZ: Possibly.

13 MEMBER WALLIS: Yes, they will.

14 MR. SCHULZ: Well, Graham, there is an
15 issue here with fluttering, smaller particles won't
16 tend to flutter as much as bigger particles.

17 MEMBER WALLIS: Well, we had a talk with
18 Graham McIntyre about maple trees, and the leaves that
19 come down, I remember that. They flutter, they don't
20 go straight down.

21 MR. SCHULZ: But if you get a small
22 particle it is going to tend to not --

23 MEMBER WALLIS: The whole point is that
24 there isn't just one trajectory.

25 MR. SCHULZ: I'm not saying there is.

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1 This is giving you a feeling for the extreme --

2 MEMBER WALLIS: This is the extreme case?

3 MR. SCHULZ: The extremely low settling
4 velocities you would need, in order to challenge the
5 screen.

6 MEMBER WALLIS: Well, I don't know yet,
7 because I don't know what particle you are talking
8 about and so on. So I guess this is all in the hands
9 of the Staff, the Staff is going to follow this up,
10 and make sure it is done right?

11 MS. STAREFOS: Yes.

12 MEMBER WALLIS: Now, what is the size of
13 the particle in this trajectory?

14 MR. SCHULZ: The particles were, are
15 basically a quarter inch.

16 MEMBER WALLIS: A quarter inch in
17 diameter?

18 MR. SCHULZ: They were selected so that
19 they could potentially clog the screens.

20 MEMBER WALLIS: So they are big particles?

21 MR. SCHULZ: They were selected to be big
22 enough to challenge the screen.

23 MEMBER WALLIS: So they are pretty big?

24 MR. ANDREYCHECK: Yes.

25 MEMBER WALLIS: So little particles would

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1 have gone right to the screen, in this picture? They
2 got through the reactor and everything else.

3 MR. ANDREYCHECK: And in fact there were
4 velocities in the reactor where --

5 MEMBER WALLIS: Another interesting
6 question for you guys is why a quarter inch mesh? I
7 mean, the mesh should be designed in anticipation of
8 the kind of debris you are likely to get.

9 MR. SCHULZ: Well, that is not how it is
10 selected, it is to make sure that everything
11 downstream, including -- in operating plants that
12 includes valves, pumps, as well as the fuel --

13 MEMBER SIEBER: Can take the debris.

14 MR. SCHULZ: That is right.

15 MEMBER SIEBER: So it will catch a bolt,
16 or something like that?

17 MR. SCHULZ: It is intended to catch stuff
18 that could cause blockage downstream.

19 MEMBER WALLIS: Beer can or something.

20 MR. CARUSO: But the fuel debris screen
21 are a lot smaller than a quarter inch?

22 MR. SCHULZ: Not for this plant.

23 MR. CARUSO: I thought you were going to
24 use a standard Westinghouse vantage fuel design?

25 (Everyone speaks at the same time.)

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1 MR. SCHULZ: We will be using the standard
2 fuel design, yes.

3 MR. CARUSO: And that has debris screens
4 that have holes that are --

5 MR. SCHULZ: -- will be consistent with
6 this screen size.

7 MR. CARUSO: So it is going to be
8 different than the one that is currently in --

9 MR. SCHULZ: That may be the case, yes.

10 MR. CARUSO: Does that mean, then, that
11 the competition decides to try sell a reload, they are
12 going to have to sell a downsized debris screen? The
13 reason I ask is fuel is not part of this review,
14 right?

15 MR. SCHULZ: That is not true, fuel has
16 been a part of the debris.

17 MR. CARUSO: Is that constraint part of
18 the DCD, is that explained in the DCD, that the fuel
19 debris screen has to be --

20 MR. SCHULZ: The latest South Texas, or
21 the latest design is consistent with a quarter inch.
22 The latest South Texas fuel assembly -- I'm saying
23 south Texas because I know that is -- so our latest
24 fuel design is consistent with that.

25 MR. ANDREYCHECK: The design for Calloway

1 is consistent with the licensing requirements to REG
2 guide 1.82, which does say that some screens eliminate
3 -- in their ECCS flow path, and that includes the
4 sprays.

5 MR. CARUSO: Is that a requirement in the
6 DCD that the fuel --

7 MR. ANDREYCHECK: I can't answer that.

8 MR. SCHULZ: Yes, it is a requirement that
9 the quarter inch be limiting blockage -- yes, it is in
10 the DCD.

11 MR. CORLETTI: The next presentation, and
12 I think we can just drive through this one in five
13 minutes, on INC, because we are going to be showing
14 you our INC --

15 MR. SOBROSKY: This is Joe Sobrosky, I was
16 hoping to kill an action item. We have John Lenox
17 here, from this morning there was questions from
18 Joelle's presentation about the associated
19 Westinghouse calculation, and identified assumptions
20 with the (inaudible) --

21 MR. CORLETTI: I understand that, and
22 we've been looking at that as well, and when you told
23 us that last night, we understand that.

24 MR. SOBROSKY: Yes, but when I heard this
25 morning we said that we had John Lenox available to

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1 address that if the ACRS was interested in it. So
2 before I let John go, did we want to address that
3 question?

4 CHAIRMAN KRESS: I think we will just let
5 you two work it out, and then we will look at it.

6 MS. STAREFOS: Thank you, John.

7 CHAIRMAN KRESS: Thank you.

8 MR. HAYES: The primary purpose for this
9 part of the agenda is simply to prepare you for this
10 afternoon's session out at the automation
11 headquarters. When I refer to 286, that is what we
12 are talking about.

13 There is actually two specific places out
14 there where there will be presentations. One is an
15 INC product demonstration, presentation and
16 demonstration. And one is presentation in what we
17 call the advance control room development facility,
18 where we are looking at concepts of advanced control
19 rooms.

20 The main point I want to make in all of
21 this is what you see this afternoon is not AP1000
22 specific. I almost want to say it is not AP1000.
23 But, yes, those products will be in the AP1000.

24 But those people are not involved with
25 AP1000 today, they are involved in product

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1 development, they are involved in developing boxes
2 that will ultimately be used to put together to make
3 an INC system.

4 The reason I can say that is because for
5 INC, and for human factors, we took a slightly
6 different approach from what we did in the fluid
7 systems. And that is what we certify, as part of the
8 design certification, is the INC design process, not
9 the design.

10 In addition to that, in the certified
11 design, or the functional requirements for the INC, in
12 fact we talked about some of them yesterday, when we
13 talked about squib valve control. But the actual
14 design of the INC, the computers and how they talk
15 together, the details of that design are not made.

16 What is certified is all the requirements
17 on the design when it is done. The COL will be
18 obligated to show that the final design meets those
19 requirements.

20 Why did we do that? This is consistent
21 with what was done with the other design certification
22 plants. The world of computers is moving very fast,
23 and we don't want to freeze a design today, when the
24 plant may not be built for a number of years in the
25 future.

1 So the intent is to allow current
2 technology, whatever current means, today we are
3 saying those words. And to give you an example, when
4 we licensed AP600, we did design certification for
5 AP600, we expected a product we called "Eagle" to be
6 the safety system.

7 Today we don't make Eagle any more, or we
8 are in the last throes of making Eagle. It has been
9 replaced with something called Common Q. Functionally
10 it is very similar, but is newer design, using newer
11 electronics, based on current design of electronics.

12 But on the other side of this I want to
13 point out that, again, for this afternoon, those
14 products are not just AP1000/AP600 products. They are
15 used in other places, and including upgrades in other
16 American plants.

17 So just in the short time frame of the
18 AP600 and AP1000, we changed the safety product. We
19 did not change the non-safety product, but that is
20 because it changed during the AP600 design process.

21 So my point here, and it is really only
22 one point, please understand, when you are out there,
23 this is not AP1000, although it relates.

24 But part of what we would like you to come
25 away with, from the visit out there, is more than just

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1 your AP1000 review, because you guys are interested in
2 other U.S. plants, also.

3 Now, with that, I will turn it over to Bob
4 Fuld, who is our leading human factors person, and he
5 is going to talk about the control room design and
6 tell you, essentially, the same story about the
7 control room.

8 MR. FULD: Thanks. I will try to be brief
9 since we are behind. I'm not really sure what you
10 thought I might address understand design acceptance
11 criteria, but I have done this sort of literally,
12 which is to say practically we were dealing with the
13 design acceptance criteria are under human factors.

14 I believe you are all familiar with ITAAC,
15 that is table in the tier 1 of the DCDs, in the
16 various Q1 sections, they all have -- design
17 commitment, the inspections test analysis column, and
18 the associated design acceptance criteria, or DAC.

19 I believe what they do is provide a firm
20 commitment to auditable, or verifiable results and
21 acceptable conclusions in tier 1, which makes it very
22 formal, and difficult to change, without a great deal
23 of scrutiny.

24 This is to provide closure to the part 52,
25 the one step licensing process for ALWR plants. And

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1 it is the responsibility of the applicant, the license
2 applicant to satisfy these criteria but the vendor, of
3 course, or anyone else can do it ahead of time, and
4 the COL applicant will be happy.

5 With respect to human factors engineering,
6 I think you -- of human factors engineers for
7 different reasons, and different context, and are
8 familiar with --

9 CHAIRMAN KRESS: Is that a definition,
10 that first bullet, of human --

11 MR. FULD: Well, that was my definition,
12 for lack of a better one. How do you like that
13 definition?

14 CHAIRMAN KRESS: We will take it, that is
15 all right.

16 MR. FULD: That is good. I'm happy with
17 it, too.

18 In the part 52 licensing process human
19 factors has emphasized review of the design process,
20 as opposed to, perhaps, more product related
21 orientation for the plant design fleet at this time.

22 But the process review is guided by NUREG
23 0711. I think you are familiar with this. The
24 product review, such as it remains, is guided by 0700,
25 and I have added validation test results to that,

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1 because I don't want the importance of this to escape
2 mention.

3 So I will propose a human factors DAC
4 confirms closure of the open elements of the human
5 factors plan, that is the 0711 plan, related plan I
6 should say. And a second overlapping item that I have
7 is that it confirms specific aspects of the tier 1
8 design description requirements for the control room,
9 the shutdown room, and the local control stations, to
10 have been met satisfactorily.

11 And this was already done for the first
12 item, and I could probably add to this list with other
13 things that are, likewise, largely redundant, but I
14 wasn't sure that it was necessary.

15 If I were to add a third I think it would
16 be the B&B activities that we conduct, which is also
17 redundant with each of these things, to some extent,
18 a subset.

19 For AP1000 it is listed in the table in
20 section 3.2 of tier 1, in the DCD. It has 13 line
21 items, some of those have a similar number of items,
22 and each of those can stand for relatively large
23 activities, so it is very high level in the hierarchy.

24 But the design acceptance criteria, the
25 formula if you like, typically states that something

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1 like a report existing concludes that something for
2 required inspection to confirm that that specific item
3 has some characteristic or object.

4 And this is sort of the boilerplate of the
5 DAC. So this sort of brings me to the end of looking
6 at DAC, here. DAC COL commitment in DCD tier 1, so it
7 has a lot of legal clout, so that they are auditable
8 or verifiable results, and acceptable conclusions with
9 the design that they have been met.

10 These commitments include, for human
11 factors, is the B&B activities, which is line 5,
12 primarily. And this brings closure to the human
13 factors design process in 711.

14 And if there are any questions?

15 MR. CORLETTI: I think --

16 MR. HAYES: Part of the reason we wanted
17 to mention this is because you will see what we call
18 the control room development facility, that looks a
19 lot like the AP1000 control room, but it is not. And
20 it is close enough that it confuses a lot of people
21 into thinking that they are looking at --

22 (Laughter.)

23 CHAIRMAN KRESS: Before we close I think
24 we probably ought to talk about this next meeting,
25 which right now is scheduled for September. As far as

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1 I'm concerned we can leave it in September, because
2 I'm going to view it as more of a progress report for
3 the full Committee, some of what we have already heard
4 here.

5 And my suggestion is, for example, that
6 for the Westinghouse people, that we have two hours,
7 and that is to be split between Westinghouse and
8 Staff, and I think Westinghouse get the bulk of the
9 time.

10 And I think we ought to discuss progress
11 on what I view was ACRS concerns. And I would list
12 these, like in the thermal-hydraulics area, I would
13 say the entrainment issue, the level swell issue, and
14 the boron precipitation issue.

15 And maybe cover these somewhat with the
16 bounding and simplified approach. The other issues
17 that I think might be of interest, that were brought
18 up by ACRS members, are the containment lambda, make
19 it a lot shorter than what we heard before.

20 And vessel retention, particularly the
21 question of where and how it breaks through the
22 vessel, and how that relates to the fuel coolant
23 interactions.

24 And the squib valve reliability, you will
25 -- we will have to convince Steve Rosin that that is

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1 okay. As far as the containment lambda, I would say
2 here is the -- why we chose this particular sequence
3 to look at, to validate what we use, and how that
4 translates into the lambda.

5 I don't know, do any of the members have
6 any choices, what about the thermal-hydraulics, did I
7 choose --

8 MEMBER WALLIS: What do you think about
9 the screens, the sump screens? Can you do that
10 quickly? Because it is an issue that we are aware of.

11 CHAIRMAN KRESS: Yes, I think that ought
12 to be part of it. Now, for the Staff, we would like
13 a status report on the open items, and maybe some of
14 the stuff that was presented to us on the confirmation
15 calculations using RELAP.

16 And I don't think they have time for much
17 more there, but that would be my guess.

18 MR. CORLETTI: So you want about two
19 hours, an hour and a half from Westinghouse, and 30
20 minutes from the Staff?

21 CHAIRMAN KRESS: Yes. And you have to of
22 course account for time for questions. But that would
23 be about my guess of the split.

24 MEMBER WALLIS: I think the more complete
25 your presentation, the more convincing, the fewer the

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1 questions, hopefully.

2 CHAIRMAN KRESS: Well, you can't count on
3 that.

4 MEMBER WALLIS: It is a self-reinforcing
5 thing, if you are disorganized, then you will get more
6 questions, and you get even more disorganized, and you
7 will take longer and longer.

8 MR. CUMMINS: We will try to do a good
9 job.

10 CHAIRMAN KRESS: Before we close I would
11 like to thank everyone. It has been a very good
12 meeting, I think we see a lot of progress. I
13 particularly thank the Westinghouse people for their
14 hospitality, and their good presentations. And Staff
15 was -- your openness was very good, so I think it has
16 been a very good meeting.

17 MR. CORLETTI: We appreciate coming to
18 Pittsburgh, and the disruption, but we were really
19 excited to have you here, and we are glad you came to
20 see us.

21 CHAIRMAN KRESS: I declare the meeting
22 adjourned.

23 (Whereupon, at 12:50 p.m., the above-
24 entitled matter was adjourned.)

25

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
Official Reporter
Neal R. Gross & Co., Inc.

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WASHINGTON, D.C. 20005-3701

DSER Open Items Planned Resolution Paths

Mike Corletti

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DSER Open Items Already Discussed with ACRS

- 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**

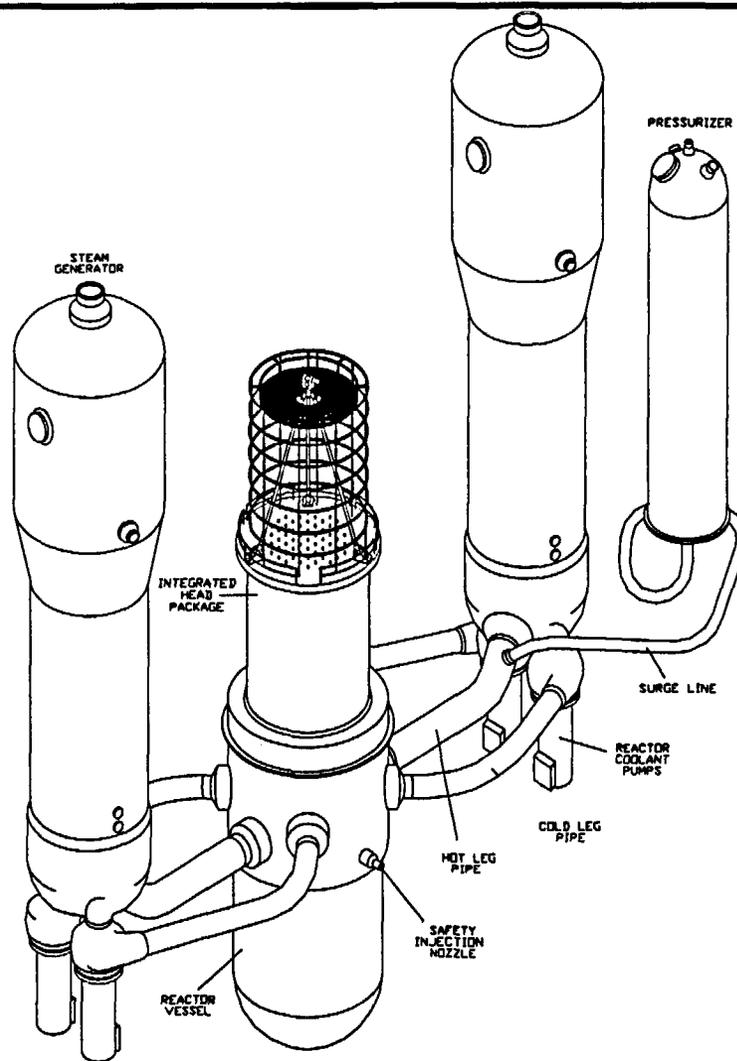
DSER Open Item: 10 CFR 50.44

- **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

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

13

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.

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

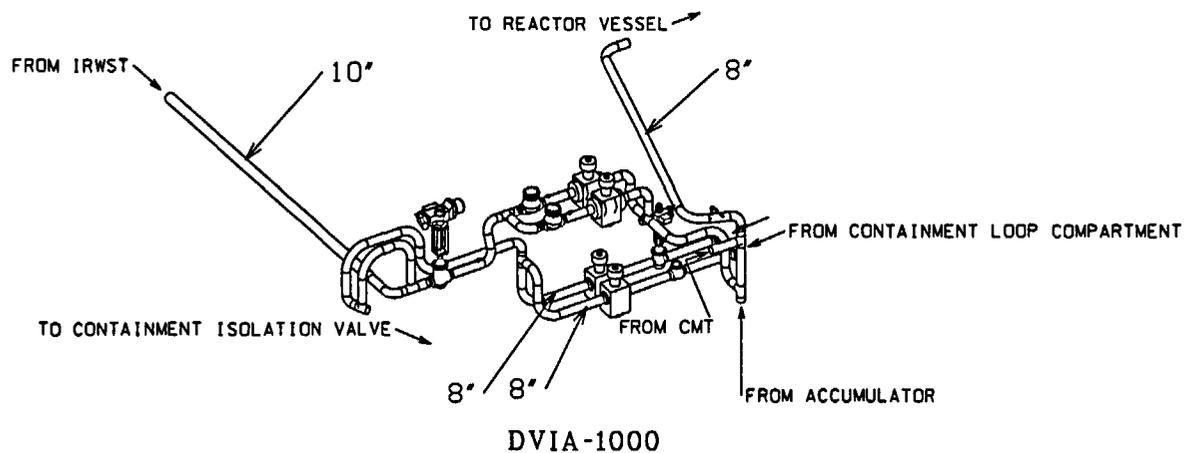
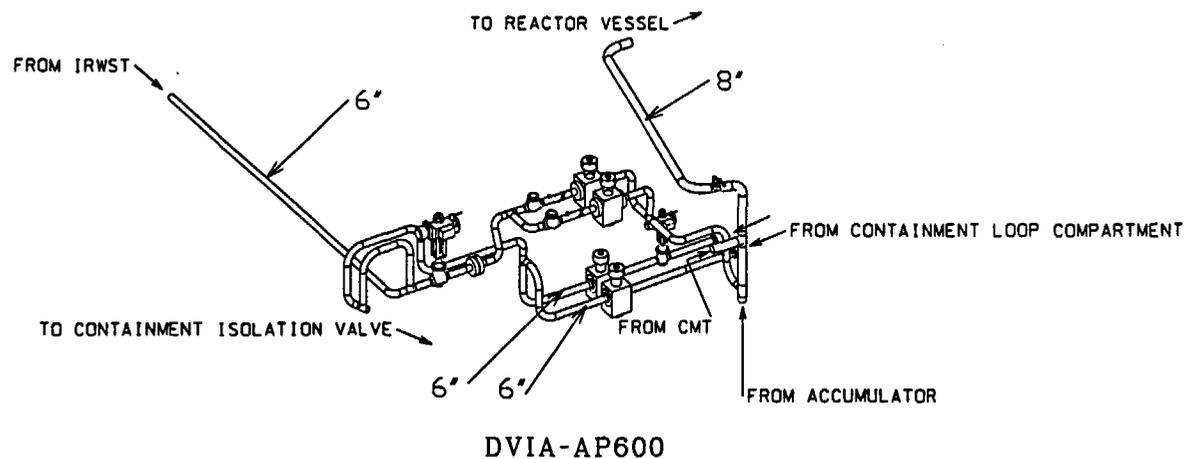
AP1000 Piping Systems Designed for LBB

- **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



AP1000 LBB Analysis Method

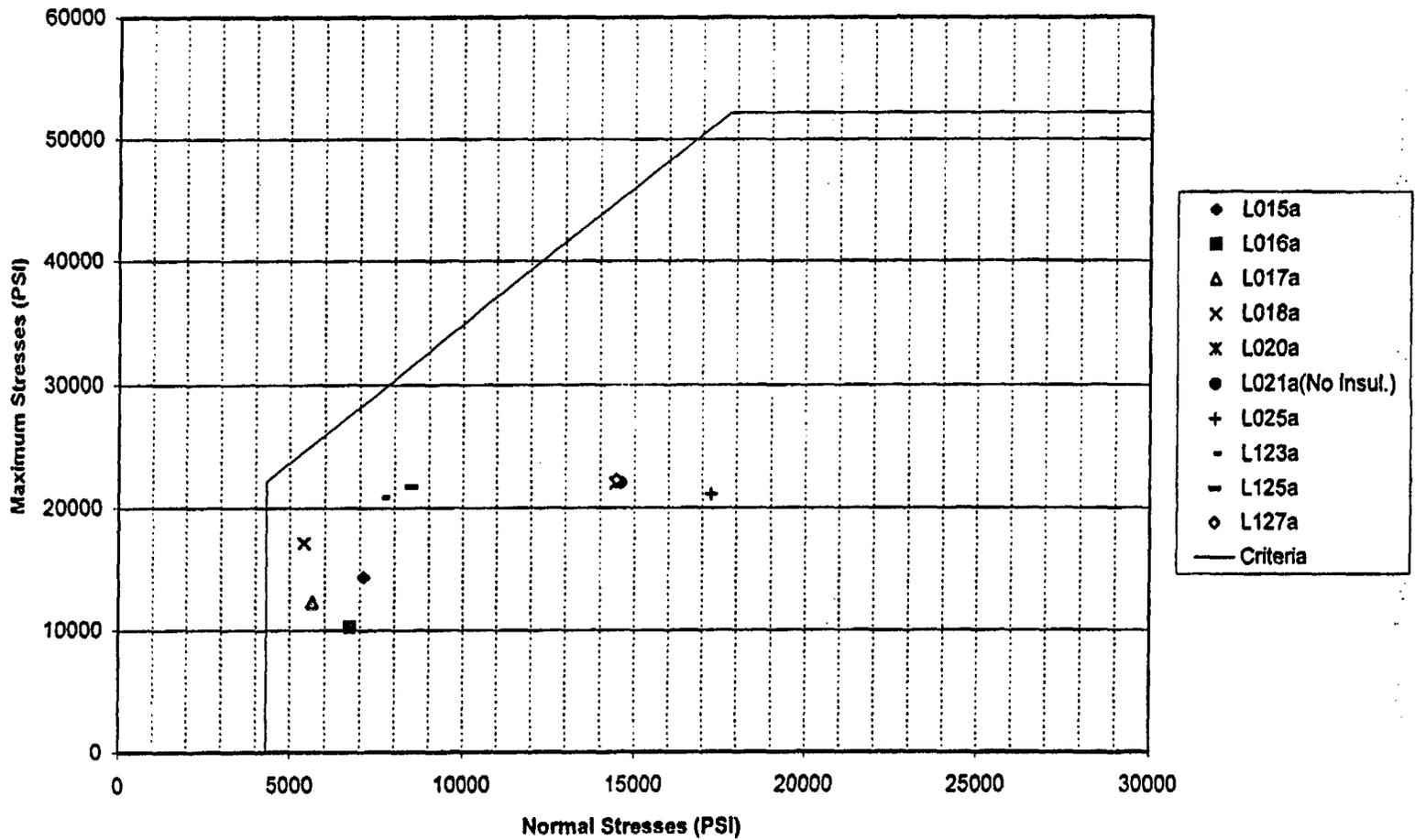
- **Leak-Before-Break Bounding Analysis Methods**
 - Develop Bounding Analysis Curves based on pipe material and pipe size
 - Bounding Analysis Curve Margins
 - Margin of 10 on leak detection capability
 - Margin of 2 on flaw size
 - Margin of 1 on load by using absolute summation method of maximum loads 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