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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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SUBCOMMITTEE ON THERMAL HYDRAULICS

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MEETING

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THURSDAY,

AUGUST 24, 2006

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The Committee met in Room T2B3 of the U.S. Nuclear Regulatory Commission, Two White Flint North, 11545 Rockville Pike, Rockville, Maryland, at 8:30 a.m., Graham B. Wallis, Chairman, presiding.

PRESENT:

- | | |
|------------------|---------------|
| GRAHAM B. WALLIS | ACRS Chairman |
| MARIO V. BONACA | ACRS Member |
| THOMAS S. KRESS | ACRS Member |
| OTTO L. MAYNARD | ACRS Member |

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P R O C E E D I N G S

(8:31 a.m.)

CHAIRMAN WALLIS: Well, good morning.

Welcome to the second day of the meeting of the Advisory Committee on Reactor Safeguards, Committee on Thermal Hydraulic Phenomena and our interesting investigation of what's going on with these studies of sump strainers.

We're going to hear from CCI this morning. Without more ado, I invite them to get started.

PARTICIPANT: Make a note that we're in open session.

CHAIRMAN WALLIS: This is an open session. We were closed yesterday afternoon. This is now an open session, and we're open for the rest of the day?

PARTICIPANT: Yes.

CHAIRMAN WALLIS: Yes. Thank you.

MR. BECK: Good morning, gentlemen. My name is Deane Beck. I'm a business unit manager for CCI Nuclear Services.

We're normally represented for regulatory type meetings by Dr. Urs Blumer. Urs is on holiday right now, and so we've asked for Tobias Zieger to speak to the group today. Tobias is our Deputy Director for Nuclear Division, and that would be

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1 equivalent of chief engineer from our Swiss factory,
2 which is where our strainers are tested and produced.

3 And with that I'll turn it over to Tobias.

4 CHAIRMAN WALLIS: Tobias Zieger is a
5 Swisse?

6 MR. ZIEGER: No. I work in Switzerland,
7 but I'm a German, and I'm probably the only non-
8 American in this room. If you cannot understand me,
9 please interrupt and ask me.

10 MEMBER KRESS: *Sprechen zie Deutsche?*

11 CHAIRMAN WALLIS: That's what I said,
12 business *Deutsche*.

13 (Laughter.)

14 MR. ZIEGER: Shall we start? So Deane
15 already introduced myself. I'm with Brunzer Defer
16 (phonetic), our Nuclear Division for all technical
17 issues.

18 As a consequence of today's presentation,
19 at first we want to speak about some general topics.
20 Yesterday I recognized that you are probably
21 interested in how such as strainer replacement project
22 is handled.

23 Then I will give you quickly some design
24 features of our strainer. I will explain test
25 facilities parameters which are important for strainer

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1 design; a reference list related to testing. Also,
2 where are we with the testing? Some key observations,
3 and then some specific topics like scaling
4 methodology, how we prepare the debris, how we
5 introduce the debris into the test loops, and I'll
6 give you also some results about chemical and bypass
7 test.

8 How does it go? Of course, at first you
9 have to study what kind of debris will be generated,
10 and how much of it -- what are its characteristics?
11 These are usually information we get from our client
12 or from our customer.

13 The next one is the same. That's
14 information we have to get from our customers because
15 to size the strainer, of course, it's very essential
16 to know how much of the generated debris will make it
17 to the sump or to the strainer.

18 This is where we come into play. When we
19 have all of this data, we usually start with the kind
20 of footprint, which means we look at the data, what
21 space is available, what is the debris condition,
22 what's the flow, et cetera, and we come up with a
23 proposal where we can install our strainer, what kind
24 of strainer we can install. So that's the point where
25 we start with our work.

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1 Then, of course, up to now it was always
2 part of the job. We are not doing only testing. We
3 do all also the head loss calculation, which is
4 primarily based on NUREG CR-6224. I think that is
5 very well known here, what it is.

6 These theoretical calculations will be
7 compared to real testing. I will explain later on
8 what kind of test beds we have and what kind of
9 testing we did, and usually you see when you compare
10 testing, especially large scale testing with the
11 calculation that there is remarkable margin between
12 the real margin between NPSH and head loss and the
13 theoretical calculation.

14 Of course, then we do the design test and
15 calculation reports, and that was the one issue
16 yesterday which came up very briefly. Of course, the
17 licensee gets all documents from us which enables them
18 to justify the sizing and design of our strainers. So
19 we do design calculation reports. We do test reports.
20 We do a design report itself, all documents which
21 justify the design are available with the licensees.

22 Okay. Last but not least, we make it and
23 sometimes at least we help to install it.

24 And now I want to give you some very brief
25 features of our strainer design. We call it pocket

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1 principle, and it was actually developed for our BWR
2 strainers. Unfortunately, we had no business in the
3 U.S. for PWR strainers, but that's where this pocket
4 design comes from.

5 And for BWR strainers, of course, a round
6 design is perfect. You usually find the flange, and
7 what's better to fit to a flange than a round piece?

8 But for PWRs the situation is completely
9 different, as you know. You have to find way to
10 install the required surface area which can be inside
11 the sump, next to the sump, on the containment floor,
12 whatever. And for this kind of installation, it's
13 much more convenient to have a rectangular shape, and
14 so we used our proven pocket principle, modified for
15 a new design used now for a the pressurized water
16 reactors not only in the U.S., of course. We have
17 worldwide projects.

18 MEMBER BONACA: May I ask a question?

19 CHAIRMAN WALLIS: You can ask a question
20 any time you like.

21 MEMBER BONACA: All right. Well, you were
22 pointing out a debris generation and debris transports
23 which are inputs from the customer of defining some of
24 the characteristics of the filters. Okay?

25 MR. ZIEGER: Un-huh.

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1 MEMBER BONACA: Both, for example, in this
2 design, I mean, what changes from customer to
3 customer? Is it the size, the real size, not
4 necessarily the --

5 MR. ZIEGER: What changes is, of course,
6 the required surface area and the volume which you
7 have available, and I think all my colleagues here
8 know it very well. It's restricted. It can be part
9 of the sump, can be the sump itself, can be a certain
10 area in the containment, and then you have to live
11 with what you get.

12 We get a certain volume, and depending on
13 this volume, we modify, for example, the depth of the
14 pocket. We usually don't modify the shape itself,
15 mean height versus width. It's more or less a
16 constant, but we vary the depth. We vary the number
17 of pockets which are in one model. We vary the number
18 of walls which are in one model. All of these are
19 more or less variables to adopt to the plant
20 situation.

21 MEMBER BONACA: But not necessarily a
22 screen. I mean, the screen stays the way it is
23 insofar as the size of the passages?

24 MR. ZIEGER: We have -- it comes later.
25 Of course, this shape here is separate.

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1 MEMBER BONACA: That's right.

2 MR. ZIEGER: That's why it's shown in a
3 different color.

4 MEMBER BONACA: Oh, yeah, sure.

5 MR. ZIEGER: It's separated and we have
6 many two hole sizes. We are using one slope and one
7 sixteenth inch --

8 MEMBER BONACA: Okay, and you do have --
9 all right. You do have a variation in that, too.

10 MR. ZIEGER: We have a variation in hole
11 size. The utilization of the punched sheetmetal is
12 about the same. It is in the range of 35 percent.

13 MEMBER BONACA: Thank you.

14 CHAIRMAN WALLIS: So this pocket is
15 smaller than the little pigeon hole into which it
16 fits? It slides into a box.

17 MR. ZIEGER: Yes.

18 CHAIRMAN WALLIS: And it is smaller than
19 the box.

20 MR. ZIEGER: This is the box.

21 CHAIRMAN WALLIS: And it is smaller
22 than --

23 MR. ZIEGER: Over here is the badger
24 (phonetic) pocket.

25 CHAIRMAN WALLIS: And that pocket is

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1 smaller than the box. So the fluid flow around
2 between the pocket and the box wall.

3 MR. ZIEGER: Yeah.

4 CHAIRMAN WALLIS: When it comes out.

5 MR. ZIEGER: What we see here, all of
6 these small pieces touch pocket.

7 CHAIRMAN WALLIS: But the pocket is
8 smaller than that. It must be smaller to let the
9 fluid flow around it.

10 MR. ZIEGER: Of course.

11 MR. BECK: It has a taper to it.

12 CHAIRMAN WALLIS: And it's tapered, too.

13 MR. ZIEGER: You see it a little bit here.

14 CHAIRMAN WALLIS: Yes, the taper. It has
15 a taper.

16 MR. ZIEGER: It has a taper, and then it
17 leaves the space.

18 CHAIRMAN WALLIS: Leaves the space. Okay.

19 MR. ZIEGER: The water flows out.

20 MR. BECK: The opening or the window is a
21 constant, but the depth of the pocket varies.

22 CHAIRMAN WALLIS: I'm tempted to ask how
23 many pigeons you can fit in this thing.

24 (Laughter.)

25 CHAIRMAN WALLIS: It looks very much like

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1 the pigeonhole in the Post Office. It does very much
2 look like the Post Office sorting system. An
3 interesting design.

4 MEMBER KRESS: Why do you vary the depth
5 of the pocket?

6 MR. ZIEGER: Because it depends, as I
7 said, on what space we have available. Sometimes, and
8 I use here a picture label, for example, we have only
9 the containment floor, but there's a wall. Next to
10 the containment floor and in between we have to fit
11 the strainer. So if you make a full length, I would
12 say our full length is 400 millimeters, but for
13 several of the cases we have to make it shorter to fit
14 two roles of models into the available space.

15 CHAIRMAN WALLIS: It looks like they're --

16 MEMBER KRESS: It looks like on the module
17 that they were different lengths in each module.

18 CHAIRMAN WALLIS: Different lengths in
19 there. The black center is tapered like this in the
20 middle.

21 MR. BECK: That's a collection box.

22 CHAIRMAN WALLIS: Yeah, but the black area
23 between the yellow there is tapered. So that the
24 pocket --

25 MR. ZIEGER: Not really.

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1 CHAIRMAN WALLIS: Not really?

2 MR. ZIEGER: It is not very precisely
3 shown.

4 CHAIRMAN WALLIS: It's not very precise.
5 Okay.

6 MR. ZIEGER: It is a kind of frame which
7 needs a rectangular (unintelligible).

8 CHAIRMAN WALLIS: Okay.

9 MR. ZIEGER: Okay. Here you see a little
10 bit more how it is made. At first this frame is
11 installed that you see here, a kind of simple
12 structure, and after installation of the simple
13 structure, the cartridges are, if you want, clipped or
14 stucked (phonetic) onto the simple structure. There's
15 only a little welding done. Only some pieces are
16 welded. Here is a connection which is welded, but the
17 overall installation is without welding, and the
18 installation unsided (phonetic) would use without
19 welding anyway. So these weldings are done in our
20 workshop before delivery.

21 And this is another microphone.

22 I think you see how it works. The
23 (unintelligible) fluid comes in here for all these
24 pockets, which provide a high surface area. The ratio
25 between the flat surface and the real surface area

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1 inside the pocket is about ten to one. So we have
2 about ten times more surface inside the pocket than on
3 this screen.

4 The water goes off and then the clean
5 water comes within two or three cartridges in a
6 channel, and these channels can be fairly long, not in
7 the U.S., but we have projects in France where the
8 total length of the strainer is more than 180 degrees
9 of the containment. So a regular chain of models.

10 And if you have any questions.

11 Three examples, real examples how a
12 strainer is installed or will be installed. That's
13 one of our (pause) -- okay. Thank you.

14 I'm not used to sit during a presentation.

15 MEMBER KRESS: You're welcome to stand.

16 CHAIRMAN WALLIS: That's okay.

17 MR. ZIEGER: Well, this is a design where
18 all of the models are placed on top of the sump.
19 Here's the sump pit, and in this case it was possible
20 to install all of the required area on top of the sump
21 pit.

22 Another design, and that's what I
23 mentioned before, is, for example, this. Here we had
24 no space or not enough space on top of the sump pit.
25 Here you see the sump. So we had to install these

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1 kind of chains, and here, for example, you see that
2 there's very narrow space available. That means in
3 this area we have different pockets. Here we have
4 pockets which are only 200 millimeters deep simply
5 because of the available space.

6 And where we have space, there we have our
7 standard pockets like here. Here's enough space.
8 These pockets are also a little bit smaller.

9 MR. CARUSO: That looks like it -- can you
10 go back there? In a case like that it looks like it's
11 sitting up against a wall.

12 MR. ZIEGER: No, that's not a real
13 drawing. That's a schematic drawing. Of course,
14 there is a distance between wall and the strainer.
15 Otherwise the strainer makes an ascent.

16 MR. CARUSO: Right. That's what I was
17 wondering.

18 MR. ZIEGER: The material has to be able
19 to go through the strainer. So that is a schematic
20 drawing; that's not a real one, but just to show the
21 different situations we are faced with usually in the
22 plant.

23 Now, of course, we need at the minimum
24 space which is always free to a wall or to the next
25 strainer. It's a minimum one foot. So it's never

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1 closer than one foot.

2 And that's the third way to install
3 strainers. There is a picture also out of the U.S.
4 and two units of this station are already installed,
5 and here the filters are inside the sump. The old
6 strainers are installed inside the sump. There you
7 see these level instruments, and here is the suction
8 line for the pump, which is, of course, covered during
9 installation.

10 MEMBER BONACA: What's the height of that
11 structure?

12 MR. ZIEGER: It's about -- I have to
13 convert from meter into feet -- it's about five feet.
14 And it depends on the number of pockets because the
15 height of one pocket is about a third of a feet, and
16 as far as I remember, we have 12 pockets here.

17 Okay. That's a little bit of a repeat
18 what I already told you. The input we need. then we
19 do the preliminary sizing.

20 Of course, also during or very close to
21 this step is the preliminary sizing. We have to
22 define what kind of test we propose, and usually as
23 the test specification, what tests are we doing, how
24 are we doing the test in agreement with the customer.
25 So we develop the specifications. Licensee looks over

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1 it, comes back with input, and then we develop the
2 specification, what we test together with the
3 licensee. That is the normal way.

4 That was also mentioned yesterday,
5 surrogate materials. We use only one surrogate
6 material, which is the replacement of paint, which is
7 a kind of stone flour, but I think it comes later with
8 some more information.

9 For the scaling, that might be also a
10 little bit different to others because yesterday I
11 heard differently, for the scaling, to come up with
12 the scaling factor for the test. We take away the
13 sacrificial area. It means all area which can be
14 covered by stickers and tapes and stuff are taken away
15 from the total amount of screened area, and then we
16 take this number to calculate the scaling factor.

17 To make an example, if you had 10,000 foot
18 available area and sacrificial area is 1,000 foot,
19 then we calculate with the 9,000 foot and, for
20 example, our testing area is 100. Then we would have
21 a scaling factor of nine feet instead of 100 because
22 we take the area which could theoretically be covered
23 by all of these stickers away from the available area.

24 Okay. Now, some information about our
25 test loops. Small scale test loop, I think it's

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1 similar to what the industry has. It's a vertical
2 test loop. Of course, due to the vertical orientation
3 there's no sedimentation possible.

4 What's also the case, and that was our
5 observation during all of these testings, it results
6 into more or less uniform debris distribution over the
7 failed surface, but this test bed is very suitable to
8 do kind of parametric studies.

9 CHAIRMAN WALLIS: Well, this doesn't have
10 pockets. This just has a --

11 MR. ZIEGER: No, no. It has pockets.

12 CHAIRMAN WALLIS: It has pockets in it?

13 MR. ZIEGER: You will see a picture. It
14 has pockets.

15 CHAIRMAN WALLIS: Ah.

16 MR. ZIEGER: It has pockets. Of course,
17 what we install in this test loop, it depends on us,
18 but usually it has pockets. We used also the same
19 test loop to make some very basic studies in the
20 beginning just as flat plates.

21 CHAIRMAN WALLIS: So uniform debris cake
22 formation, that's around the walls of the pocket it's
23 uniform?

24 MR. ZIEGER: Of course, it depends on --

25 CHAIRMAN WALLIS: This will go to the

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1 bottom of the pocket, and then when it's placed in the
2 vertical --

3 MR. ZIEGER: It depends on a lot of --

4 CHAIRMAN WALLIS: It must depend on a lot
5 of things.

6 MR. ZIEGER: It depends on the density of
7 the material you put in. It depends on the ratio
8 between fiber and particle leads, for example. Of
9 course, if you have a lot of heavy stuff, it sinks
10 down.

11 CHAIRMAN WALLIS: To the bottom of the
12 pocket, yet.

13 MR. ZIEGER: Yeah, but if you make a test,
14 mainly this fiber, and you are using fine fibers,
15 then it distributes very nicely. It depends very
16 much.

17 CHAIRMAN WALLIS: Yeah.

18 MR. ZIEGER: It depends very much on the
19 material.

20 CHAIRMAN WALLIS: It's like the inside of
21 a vacuum cleaner bag.

22 MR. ZIEGER: Yes.

23 CHAIRMAN WALLIS: Very similar. I just
24 asked you because you said it's uniform, and it's not
25 always uniform.

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1 MR. ZIEGER: No, no. It depends very much
2 on the debris, but it is more uniform if you compare
3 the same situation, small scale and large scale. It
4 is more uniform than what you see in the large scale
5 test.

6 MEMBER MAYNARD: The orientation of the
7 bag is vertical. It's in a vertical tube?

8 MR. ZIEGER: Yes. But there is a picture
9 coming. But you'll see a picture very soon.

10 Parametric studies, what I mean with this
11 is, for example, if you want to see or if the customer
12 wants to see what's the influence if I, for example,
13 replace some of my fibers with I don't know what, we
14 can do this very quickly because on this vertical test
15 loop we can do about five to six tests per day. On
16 the whole frontal one takes much longer and costs much
17 more money.

18 So for these kinds of parametric studies
19 we like to use this test to compare Situation A with
20 Situation B, not to make quantitative assumptions or
21 quantitative statements, but to compare situations to
22 each other. It's a good thing. Of course and it's
23 also used not so much for the earth project, but much
24 more to my surprise for the Japanese project.

25 The vertical test loop is used to prove

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1 that the NUREG CR-6224 is always conservative, and it
2 is conservative. We find to my knowledge we didn't
3 find any case where the calculation was lower than
4 what we tested, even in the small test loop.

5 Yeah, and justification of surrogate
6 materials --

7 CHAIRMAN WALLIS: It was lower or higher?

8 MR. ZIEGER: Huh?

9 CHAIRMAN WALLIS: You're calculating
10 always --

11 MR. ZIEGER: Higher.

12 CHAIRMAN WALLIS: -- more than you
13 observe.

14 MR. ZIEGER: Yes. And the calculation is
15 very much based on the formulas.

16 CHAIRMAN WALLIS: Do you have any thin bed
17 effects, what's called a thin bed effect?

18 MR. ZIEGER: No, we didn't observe it. It
19 comes later as a conclusion, but I know this
20 discussion with a one eighth of an inch and three
21 millimeter, and in the calculation you can perfectly
22 show this. In testing we haven't seen this up to now.

23 MEMBER KRESS: Could you explain that last
24 bullet?

25 MR. ZIEGER: Which one?

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1 MEMBER KRESS: The justification.

2 MR. ZIEGER: Yeah.

3 MEMBER KRESS: The justification of
4 certain fields. How do you do that?

5 MR. ZIEGER: Because the use of real
6 material is also sometimes a question of availability,
7 not to produce a lot of this paint stuff. It's
8 sometimes not possible. And for the small scale test
9 we need only a small quantity and then we do a test
10 with original stuff and we do a test with --

11 MEMBER KRESS: You do the original.

12 MR. ZIEGER: Yes.

13 MEMBER KRESS: That's what I was --

14 MR. ZIEGER: Yes, yes. To justify that
15 the surrogate is at least a principal
16 (unintelligible) or a similar replacement for --

17 CHAIRMAN WALLIS: So this is ersatz
18 material?

19 MR. ZIEGER: Yes, *ersatz* material.

20 Okay. There is a drawing --

21 MEMBER KRESS: You're stretching my
22 knowledge of German.

23 MR. ZIEGER: It's a very simple device.
24 It's an open loop, of course. The test model is
25 sitting here, and the test model for the PWRs, I must

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1 say, is sitting here. If we test for BWRs where we
2 have a conical test because of the round shape, then
3 the test we do is sitting here. There are two
4 possibilities.

5 Yes, then we have the usual things you
6 need. We have pressure transmittals. We have a flow
7 measurement, of course, and most of the test loop is
8 made out of transparent material, plexiglass, to see
9 what happens.

10 MEMBER KRESS: Is that open at the top
11 where you dump in the debris?

12 MR. ZIEGER: That's open, yeah.

13 CHAIRMAN WALLIS: Well, you must be
14 limited in the pressure drop if it's open.

15 MR. ZIEGER: Yes, we are limited in
16 pressure drop to a little bit less than the height of
17 the whole equipment.

18 And that's a picture. Here you see this
19 plexiglass model. PWR test model is installed here.
20 That is the lower part of it that's a pump. That is
21 our GSRE, our flow meter, which is an adjusted valve
22 to regulate the flow a little bit. It think it's not
23 spectacular. It's a loop to circulate water.

24 CHAIRMAN WALLIS: That's the same thing?

25 MR. ZIEGER: It's the same. It's not so

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1 good here.

2 Here you see the test model itself a
3 little bit better. Here a model is installed with six
4 pockets. You see here one, two, three, and two
5 pockets where we can test only six pockets on our
6 small scale test loop.

7 MR. CARUSO: So the pockets oriented --
8 where's the opening?

9 MR. ZIEGER: Here.

10 CHAIRMAN WALLIS: At the top.

11 MR. CARUSO: At the top. Okay.

12 MR. ZIEGER: The debris falls directly on
13 top of the pockets, and this is the orientation at
14 least for our design which you never find in a plant
15 because in the plant the pockets are always oriented
16 (unintelligible).

17 MR. CARUSO: So -- I'll let you finish.
18 I just wonder how -- that to my mind introduces all
19 sorts of distortions to the test, doesn't it?

20 MR. ZIEGER: No. But as I said, because
21 all debris makes it to the strainer and there is a
22 relatively large way from the pipe, which is up here,
23 to the surface of the strainer, though it has time to
24 distribute itself, here to this. The debris loading
25 in the strainer is relatively -- we discussed it

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1 before depending on density, et cetera, et cetera --
2 relatively uniform, which is, of course, conservative.

3 I think it's known to everybody here the
4 worse thing you can have is a nicely equally
5 distributed debris bed, and all that is unequal makes
6 you unhappy because it reduces the head loss.

7 CHAIRMAN WALLIS: Reduces the head loss.

8 MR. ZIEGER: Yes.

9 MR. CARUSO: The debris does not
10 accumulate at the bottom of the pocket.

11 MR. ZIEGER: Of course if the amount of
12 debris is so much that you still have something on top
13 of the pocket, then yes, but it depends very much on
14 the actual situation in the plant. We have plants
15 with very low fiber content where the debris bed with
16 an equivalent thickness is in the range of three, four
17 millimeter.

18 And then, of course, you see nothing here,
19 but yet --

20 MR. CARUSO: I was just thinking in your
21 test loop there because you've got the mouth of the
22 pocket up, why doesn't all of the debris just
23 gradually wash itself to the bottom?

24 CHAIRMAN WALLIS: And just flow through
25 the walls holding --

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1 MR. ZIEGER: Because it has to flow
2 through the holes in the sheetmetal, because inside
3 here are these pockets, and the water has to go
4 through outside. There is no peak opening that it
5 just can flow through, of course. It has to go
6 through the holes, which held the debris back, and
7 then it comes out to the side internally because, of
8 course, between two pockets is a space. Otherwise the
9 water cannot flow. Yeah, it goes out in this
10 direction, in this direction, a little bit to the
11 bottom because this lower part is also separated.

12 MEMBER KRESS: Are there more holes in the
13 top than there are in the bottom to uniform the flow?

14 MR. ZIEGER: No.

15 MEMBER KRESS: No.

16 MR. ZIEGER: It's equal (unintelligible)
17 distributions. The distance between the holes is
18 always the same.

19 MR. BECK: The pocket is tapered.

20 CHAIRMAN WALLIS: It looks like a bag
21 house for those who are familiar with coal plants.

22 MR. ZIEGER: Okay. More questions on
23 small scale testing? No.

24 Large scale test loop, of course, it's a
25 completely different roof. Horizontal flow and you

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1 have gravity effect. You have sedimentation, but it's
2 more realistic, in my opinion.

3 As a result of this, the debris
4 distribution is not uniform over the strain or module.
5 It means in the lower pockets we usually find more
6 debris than in the pockets (unintelligible), and all
7 of the pockets itself are not loaded uniformly.

8 CHAIRMAN WALLIS: Are you going to show us
9 any data?

10 MR. ZIEGER: Yeah. Some data are coming
11 later on.

12 CHAIRMAN WALLIS: So you're going for the
13 data prize, are you?

14 MEMBER KRESS: There's a price for
15 somebody that shows data.

16 CHAIRMAN WALLIS: There's a prize for the
17 best data, right.

18 MR. ZIEGER: What we found just as a rough
19 figure, and of course, you cannot take it as a fixed
20 value, but approximately the ratio between small scale
21 tests and large scale tests with the same kind of
22 debris, of course, with a different scaling factor
23 because the surface is bigger in the large scale test
24 than in the small scale test, but all the rest is the
25 same, the same flow, the same approach velocities, the

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1 same debris mixing. We find about a ratio of ten to
2 one between small scale test and large scale test.

3 For example, if you --

4 CHAIRMAN WALLIS: It's interesting because
5 it means that you've got to be careful about scaling.
6 There's something different about the large scale
7 test.

8 MR. ZIEGER: Yeah, and the difference is
9 the non-uniformity.

10 CHAIRMAN WALLIS: Non-uniformity, right.

11 MR. ZIEGER: Because you have areas --

12 CHAIRMAN WALLIS: It's gravity.

13 MR. ZIEGER: -- yeah, which are more or
14 less free, and then I have only my clean head loss,
15 which is much less than debris head loss.

16 There is a drawing.

17 CHAIRMAN WALLIS: I've seen this somewhere
18 else.

19 MR. ZIEGER: And the large scale test loop
20 is used to test an entire module. Of course, maxi
21 hole chain of modules, if we have a chain of 180
22 degrees, we have to find a test bed first. But here
23 we can test the whole module, which means, for
24 example, six gussets (phonetic), three gussets here,
25 three gussets here on each side. The total number of

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1 pockets we can test there is about 300 or so, but it
2 comes later.

3 And then we circulate water, of course.
4 To introduce the water here, we have the special pipe
5 which produces certain turbulences just to avoid
6 settling of debris already here. So we make it
7 intentionally turbulent to bring as much debris as
8 possible to the pockets itself, but usually in 90
9 percent of the cases I would say, we introduce the
10 debris directly here. Directly in front of the
11 pockets we dump it in.

12 CHAIRMAN WALLIS: Do you ever do
13 experiments where the whole thing is covered with
14 debris?

15 MR. ZIEGER: Yes.

16 CHAIRMAN WALLIS: Where there's so much
17 debris --

18 MR. ZIEGER: Yes.

19 CHAIRMAN WALLIS: -- that it covers
20 everything?

21 MR. ZIEGER: A picture will come.

22 CHAIRMAN WALLIS: A picture of that.

23 MR. ZIEGER: But it's not covered with
24 fiber. It's covered mainly with RMI. So that's one
25 plant which has a huge amount of RMI and not so much

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1 fiber, and there the strainer is completely covered.
2 It submerge this RMI. There's a picture coming soon.

3 Okay. We did about 200 ones in this
4 large-scale test that is the example of a test model.
5 That's what we already saw, but I bring it again.

6 Because of these situations here, we have
7 to adjust the test bed itself, and for this we have
8 these kind of walls. So we can move the walls either
9 to make a kind of flow channel or we can move the
10 strainer module next to the wall to have the right
11 distance between test model and wall in the blind. So
12 we are very flexible with these kinds of things to go
13 S, close S, possible to the real situation.

14 MEMBER KRESS: Are the walls helpful in
15 the sense that they probably reduce the pressure drop
16 by making it more non-uniform?

17 MR. ZIEGER: No. The walls are mainly
18 used to make the geometry which you'll find in the
19 plant.

20 MEMBER KRESS: I knew that.

21 MR. ZIEGER: Okay. There's a test model.
22 These are separation plates. These are two pictures,
23 first a picture with what you called thin bed. Of
24 course, the picture was taken after the water was
25 drained out of the pool, where we have no diver with

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1 a camera to make pictures.

2 Then as the debris collapses, of course,
3 during operation it was sitting here around the pocket
4 surface, and here you see how thick it approximately
5 was. So I would say that it is in this range of the
6 thin bed testing, but we didn't find a peak in head
7 loss.

8 MEMBER MAYNARD: Did you restart the pumps
9 for any of these tests to see what happens to the
10 debris that's fallen off or that has fallen down? Was
11 it picked back up?

12 MR. ZIEGER: Not that I'm aware of. I'm
13 not sure if we did this kind of testing.

14 CHAIRMAN WALLIS: I don't see any
15 chickens.

16 MEMBER KRESS: No, no eggs or anything.

17 MR. ZIEGER: And this is another picture
18 with much more debris in the pockets, but you see also
19 here it's not uniformly. Some of the pockets are
20 almost full. some of them are almost empty. So you
21 have all of this areas here, way level, where you only
22 have clean strainer head loss, and this explains the
23 big difference between small --

24 MEMBER BONACA: But is it because it
25 collapsed there?

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1 MR. ZIEGER: Partly, yes.

2 MEMBER BONACA: Partly, yes.

3 MR. ZIEGER: Partly, yes, but this, for
4 example, or this one here was never full, also not
5 during operation, and this one here, I think, was
6 almost full, and in between the water partly
7 collapsed.

8 Then we have the third test loop which we
9 call multi-functional test loop, and this test loop is
10 mainly used to do chemical tests, but we also do --
11 it's a moment for one of our customers. We do a
12 transportation test. The test loop is relatively
13 long, but less meters, and then we introduce different
14 kind of debris far away from the strainer, and with
15 the flow we will have in the plant, we test how much
16 of the debris is transported. That was with one of
17 our customers and just going on in (unintelligible).

18 But we can also use the test loop for
19 chemical tests. We use it for bypass testing, how
20 much of the fiber goes through the screen, and I think
21 due to this relatively long channel and velocities
22 which are close to the reality, it's also a good test
23 loop to show the so-called near field effect.

24 That's a picture, but it's only a part of
25 the situation. In reality we have another four models

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1 here because the test loop is longer than what is
2 shown here on this drawing.

3 Up till now we did about 130 test runs,
4 and that's again a schematic picture. The test model
5 is sitting here. That's a small one. It can be up to
6 ten pockets in height when it's about this size, but
7 of course, the water level is still higher. So that's
8 the test -- oh, sorry.

9 Maximum, 40 pockets. That's the biggest
10 one, but this, what is shown here is not 40 pockets.
11 It's maybe 15 or so or 18. Then what we also have,
12 but have used it sometimes, sometimes not, and you
13 will see later on why. To be conservative, the
14 requirement was to bring all of the debris to the
15 strainer, which is difficult, and we heard it
16 yesterday several times. It's not so easy to bring
17 all the debris to the strainer because the water
18 velocity is low. The flow velocity of the water is
19 very low, and so it's difficult to transport.

20 Then we looked for solutions to bring the
21 debris more or less forced to the strainer without
22 pushing it to the strainer over-over conservative
23 because then we would create or we would reduce the
24 porosity, increase density. So it makes no sense to
25 push it manually in the strainer and then we were

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1 looking for provisions.

2 It's a kind of -- I don't know how you
3 will call it -- a guide where the debris can slip more
4 or less throughout the strainer.

5 CHAIRMAN WALLIS: Are you going to talk
6 about what you find on this bypass filter model?

7 MR. ZIEGER: Yeah.

8 CHAIRMAN WALLIS: You are going to talk
9 about that.

10 MR. ZIEGER: Yeah, I give you some
11 results.

12 And then here is a bypass filter very
13 similar to what we saw yesterday, I think. The water
14 is circulating here and it has to go through this
15 filter and all that goes with the water through the
16 main filter will be caught here. Well, not all; it's
17 five micron, but almost all will be caught here in
18 this filtermatte, and then the filter is taken out and
19 it's applied and it's weighted, and in one case we
20 also analyzed the size of the fiber and just used the
21 result later on.

22 This is a summary of the parameters of our
23 test loops, small scale, log scale and multi-
24 functional test loop. Log scale is 120 pockets
25 maximum.

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1 CHAIRMAN WALLIS: What does scaling
2 factors mean here?

3 MR. ZIEGER: Scaling factors mean what I
4 explained before. For example, you have 10,000 square
5 foot in the plant.

6 CHAIRMAN WALLIS: Really these are full
7 scale tests. Every pocket is full scale., isn't it?

8 MR. ZIEGER: The pocket, yes.

9 CHAIRMAN WALLIS: Right.

10 MR. ZIEGER: But we cannot test 10,000
11 square foot because then you would need a big pump and
12 we would need more or less a power plant.

13 CHAIRMAN WALLIS: Yeah, that's right.

14 MR. ZIEGER: And to come up with the real
15 water flow, with the real amount of debris, we have to
16 scale it down because we cannot put all of the debris
17 which is dimension for 10,000 square feet and 1,000.
18 that's not realistic. So we have to scale it down,
19 and that's meant with a scaling factor.

20 And it varies because as the debris load
21 in the plant varies. These are typical flow ranges,
22 temperatures. At the moment we are not able to do
23 testing at high temperatures, let's say 70, 80, 90
24 degrees because for this you would need a closed loop.
25 You would need completely different equipment. We can

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1 test only with slightly increased temperature compared
2 to ambient.

3 MEMBER KRESS: Do you scale your results
4 by temperature for the post scale?

5 MR. ZIEGER: The results are scaled with
6 the viscosity because due to the very low flow we
7 have, laminar flow, and as long as you have laminar
8 flow you can scale with the viscosity, and that's what
9 we are doing. We measure the temperature during
10 testing continuously, and then the results are scaled
11 to the design temperature by viscosity.

12 Some design parameters, high, low. The
13 maximum would be design up to now was 19,000 square
14 foot, but this is worldwide. So 19,000 in France,
15 which is famous P.J., which has more than 180 degrees
16 of containment strainers. That's not U.S., the
17 19,000, down to 2,300, an average. An average size is
18 the range of 5,000 square foot, which is installed
19 over here in the U.S.

20 When screen approach velocity, with screen
21 approach velocity, I mean equivalent velocity to the
22 entire filtering surface, the pocket area, if you
23 want, and this is in this range.

24 CHAIRMAN WALLIS: Twenty-one feet of a
25 vertical. That is crazy.

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1 MR. ZIEGER: The pocket approach velocity,
2 it's the footprint, if you want. You have the pocket
3 itself which will provide about ten times more area,
4 and then you have the inlet phase of the pocket.
5 That's the velocity there.

6 What we see usually, we also saw these
7 figures yesterday, but yesterday I think the lowest
8 number was 0.6. We saw down to 0.1, but again, that's
9 not U.S. That's France. Thirty centimeters, I think,
10 and that's the reason why we needed these 90,000 --

11 CHAIRMAN WALLIS: That's .1 foot? That's
12 three centimeters.

13 MR. ZIEGER: Three. Sorry. Three
14 centimeters, yeah. That's nothing.

15 CHAIRMAN WALLIS: That's (speaking
16 German).

17 MR. ZIEGER: yeah. And of course, that's
18 the same. That's the same plant, 19,000 and 0.1. And
19 the average is about three foot.

20 When temperature doesn't vary so much what
21 we see there is between 212 and 190. The design
22 temperature, of course, the relevant temperature for
23 the next positive section. An average is about 200.
24 Our hole size, mainly still 2.1 millimeter, which is
25 one-twelfth of an inch. Some of the newer orders we

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1 got with a hole size of one-sixteenth of an inch.

2 MEMBER BONACA: The filtering surface
3 area, I mean, you are constrained by the sump size, I
4 guess. How do you make the choices there? I mean,
5 for example, in the French reactor we have 19,000
6 square feet.

7 MR. ZIEGER: Yeah, because the modules are
8 not in the sump. The modules are at the containment
9 wall.

10 MEMBER BONACA: Yeah, in the containment
11 wall.

12 MR. ZIEGER: And more than 180 degrees.
13 There's almost the whole containment is still this --

14 MEMBER BONACA: But the question then
15 becomes for the low, for example, is 0.1 an adequate
16 MPSH margin?

17 MR. ZIEGER: I cannot answer this question
18 because that was the input we got at least from EDF.
19 These are all EDF plants, and EDF gives us the input,
20 MPSH allowable debris, et cetera, et cetera. Why it
21 is so low I do not know.

22 MR. CARUSO: What's the open area in your
23 strainers? How much of the strainer is open? Fifty
24 percent?

25 MR. ZIEGER: You mean the ratio between

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1 total sheetmetal and punched?

2 MR. CARUSO: Yes.

3 MR. ZIEGER: It's about 33 to 35 percent.

4 MR. CARUSO: Open?

5 MR. ZIEGER: Open. So that is where we
6 are with the testing. At the moment all of the small
7 scale-large scale testing is done, except with Calvert
8 Cliff, because this is an order we got very recently.
9 It's under preparation.

10 Bypass testing will stand for three units
11 or three plants up to now. At the moment, but it's
12 almost finished now, the transport testing for Oconee
13 is ongoing, and for the Exelon plants we did chemical
14 tests. That's just to give you a figure, what we are
15 doing worldwide. We are working on a lot of other
16 things, for example, and still BWR strainers may be a
17 surprise because the Japanese did nothing u till now,
18 and now we have a very good contract with Toshiba.

19 Generic test observations, that was
20 already mentioned several times. Uniform debris beds
21 are not formed in realistic conditions. At least we
22 haven't seen it up till now, and this has to do with
23 this one.

24 It's difficult to get all of the debris to
25 the screen. You really have to think how to do it.

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1 We tried this slit. We stirred it with a kind of
2 mixer. We made it with a shovel. We did all kinds of
3 things, but in reality, nobody will stay there and
4 make it. So you will have settling. That's
5 absolutely clear, but I can imagine the problem is to
6 justify how much settling you'll have.

7 You will have sedimentation. For me
8 that's absolutely clear, but how much it is in
9 reality, that might be difficult to determine.

10 As I already mentioned also, up to now we
11 have not seen such a thin bed effect in testing. Of
12 course, in calculation you'll use it every time in the
13 calculation, but in testing, we haven't seen it.

14 We have seen a kind of centered effect
15 when we tested for the Japanese, and the Japanese have
16 a lot of calcium silicate. Then we saw one time not
17 really a peak, a very small thing, in this range of
18 about three, four millimeter bed thickness, but for
19 the American plants, we have never seen such a thing.

20 then what we also have not seen in our
21 testing in (unintelligible), a strain completely
22 covered with debris or with fiber was not the case,
23 but what we have seen is a filter completely covered
24 with RMI, and I hope the picture will come through.
25 Here it is.

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1 Underneath the RMI is the model. This is
2 a model. There it's completely submerged. It's about
3 from here, from the upper part of this wall, to the
4 upper surface that's the strainer. It is, I would
5 say, about half a foot. So it's completely under RMI.

6 MEMBER KRESS: That might just make a
7 better filter.

8 CHAIRMAN WALLIS: Yeah, it is.

9 MR. ZIEGER: What we also found, I don't
10 know if somebody talked about this already because I
11 don't think we are the only one to find that. Can I
12 use this?

13 MEMBER KRESS: Yes.

14 MR. ZIEGER: Because otherwise it's
15 difficult to explain the so-called bore hole effect.
16 The effect would be (unintelligible). We made a test.
17 What you see here is the head loss. It's the pressure
18 we measured.

19 We added the debris, particulates, fiber,
20 all this stuff. When we let it go, you already see
21 here kind of these things when we let it go, and here,
22 actually here, not here; here we added RMI. And in my
23 opinion what happened there was due to RMI, we put
24 weight on the debris bed. We made it denser. We
25 increased the head loss, but in reality it didn't

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1 increase. It broke through some of the holes, and the
2 mechanics, I think, is like this.

3 If this is the hole and you start loading
4 with debris, you're building up a kind of bridge here,
5 and of course, in my opinion you need particles which
6 are able to make this bridge. This fiber, it's
7 relatively quick. If you have only particulates, for
8 example, only paints, it takes much longer.

9 So you build up this kind of bridge, and
10 as long as the pressure increases slowly because you
11 put more debris on and more debris on, it's okay, but
12 if you put like the RMI on one shot, more debris and
13 more weight, then it will be denser. The delta P
14 increases and it breaks through, and you see it
15 perfectly.

16 On the small scale test loop you can see
17 it very good because there we have the plexiglass and
18 directly behind is a filter model, and you see this
19 effect. Sometimes it's like small explosions. Then
20 it breaks through, and then it causes exactly the
21 opposite what you would expect. The pressure goes
22 down instead of up.

23 That's the so-called bore hole effect, and
24 we see it from time to time. And, of course, when you
25 have this one, you cannot anymore scale the test

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1 result with the temperature because the reason why we
2 have seen it here is the relatively high pressure drop
3 at low temperature. At 60 or 80 or whatever degree or
4 close to 100, you would not see this pressure drop.
5 That means you would not break through this debris
6 bed.

7 From here on, it's not really realistic or
8 reliable to scale the test results with the
9 temperature because in reality, all this would happen
10 at a much lower pressure level but at a higher
11 temperature.

12 CHAIRMAN WALLIS: Did you try this in your
13 small scale facility? You have a pocket with
14 fiberglass and then you add some RMI. Do you get a
15 similar effect?

16 MR. ZIEGER: Not only RMI. You can try it
17 if you want sometimes. If you --

18 CHAIRMAN WALLIS: But the small scale
19 facility, you have better ability to understand what
20 is happening.

21 MR. ZIEGER: Yes, because you see it
22 perfectly.

23 CHAIRMAN WALLIS: Right. So you can
24 duplicate this in the small scale or maybe not yet.

25 MR. ZIEGER: This was --

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1 CHAIRMAN WALLIS: This is a big scale
2 test, isn't it?

3 MR. ZIEGER: Yes, this was a big scale
4 test. You see the same effect, but visually during
5 testing is the best possibility to see if it's a small
6 scale test.

7 CHAIRMAN WALLIS: Right.

8 MR. ZIEGER: But it happens, of course,
9 over on the large scale test.

10 MR. BECK: So we also did it on the small
11 scale then?

12 MR. ZIEGER: Yeah, yeah.

13 MR. BECK: Good.

14 MR. ZIEGER: That's where we found it or
15 where we recognized it. Because it's alike a small
16 explosion. Suddenly it comes through some of the
17 holes, and then it's covered again.

18 MEMBER KRESS: Does that become part of
19 the bypass then?

20 CHAIRMAN WALLIS: Yes.

21 MR. ZIEGER: Of course it has to do with
22 the bypass, yeah. A lot of this bore hole effect,
23 your bypass will be higher. That's clear, but on the
24 other hand, just when we talk about bypass, my
25 opinion, or that was at least our observation. Sooner

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1 or later the water is absolutely clear. The bypass
2 goes to zero, and it has to go. Otherwise you can
3 never justify a one-year cooling period and still
4 keeping the allowable bypass, which is maybe the
5 maximum for the fuel.

6 So it has to go to zero, and the filter
7 regarding bypass, the real filter, is not the punched
8 hole. It's the debris by itself.

9 CHAIRMAN WALLIS: You mentioned a one-year
10 cooling period.

11 MR. ZIEGER: That's what we saw sometimes
12 in the specification, yeah.

13 MEMBER KRESS: That's a European
14 requirement?

15 CHAIRMAN WALLIS: One-year cooling period?

16 MR. ZIEGER: Maybe it's from the French
17 plants, yeah.

18 CHAIRMAN WALLIS: So this has to survive
19 for a year.

20 MR. ZIEGER: Yeah.

21 CHAIRMAN WALLIS: With no problem, no
22 additional chemical effects over a whole year?

23 (Laughter.)

24 MR. ZIEGER: Okay. That is the bore hole
25 effect. Scaling I've already mentioned.

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1 Temperature. Our tests are mainly at room
2 temperature, and the conversion is by viscosity.

3 If I can explain something more.

4 CHAIRMAN WALLIS: That's okay. Please go
5 on.

6 MR. ZIEGER: Okay. By temperature, except
7 when you have effects like this bore hole effect, then
8 it's not more realistic to do it by temperature.
9 Geometry, that was already mentioned. We usually take
10 not credit for settling, except it is a test to show
11 how much the settling is, what we are doing now for
12 Ocone, but for the moment, Adler's (phonetic)
13 testing, we dump it directly in front of the spring so
14 that it all makes --

15 MEMBER KRESS: When you get your
16 specifications from the customer --

17 MR. ZIEGER: Yes.

18 MEMBER KRESS: -- has he taken credit for
19 some settling in giving you the quantity?

20 MR. ZIEGER: No. In the sizing we never
21 took credit up to now, but I have the impression that
22 the licensee wants to know if the margin -- for
23 example, we don't take credit. We make the sizing.
24 We do the testing, small scale, large scale, and then
25 we find out we have 25 percent margin or whatever.

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1 The licensee wants to know if the margin
2 is probably even higher, and then we do all of this
3 kind of additional testing.

4 Bypass test. How it was made, I think I
5 explained. We catch the by-pass on this mat,
6 filtermatte, and then we apply it and we weight it, et
7 cetera, et cetera.

8 These are some data points. All of these
9 wet points were made with a hole size of 2.1
10 millimeter or one-twelfth of an inch. What varied,
11 and all of these tests were made with the same flow or
12 with the same approach velocity of 0.004 approximately
13 foot per seconds.

14 And the number you see here is related to
15 1,000 square foot of filter area. If you have 5,000,
16 in reality you have to multiply this number by five.

17 The reason why we are not talking about
18 percentage, it's exactly what you see here because you
19 see here with the theoretical or with the equivalent
20 fiber bed thickness of about half an inch, we find
21 bypasses in this range and the difference comes from
22 a variation in test procedure. It was always the same
23 condition, but we varied the test method.

24 So you will find the amount of bypass
25 around one cubic foot per thousand (unintelligible).

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1 When we increased the fiber load to three inch
2 equivalent, six times more, nothing happened. By pass
3 is the same. That means as soon as you build up a
4 certain debris bed on top of the metal of the screen,
5 and this is acting as a filter actually, you can put
6 on what you want.

7 Of course, you increase head loss. That's
8 not a head loss test. You increase head loss. That's
9 clear, but you don't change anymore or --

10 CHAIRMAN WALLIS: But this is true if you
11 have pretty homogeneous debris and it comes in and it
12 fills all of the pockets. In reality you probably
13 have more settling and more debris on the bottom, and
14 so the top ones have a thin -- the high pockets may
15 have a lower thickness. So this theoretical is some
16 sort of average you have here.

17 MR. ZIEGER: It's not theoretical. These
18 are test results. This is inch over every pocket?

19 I'm just saying in reality you probably
20 have thin layers on the top pockets and thicker layers
21 on the bottom because of settling.

22 MR. ZIEGER: That's exactly the reason,
23 what you're mentioning, that we, for example, didn't
24 find a difference how we make it turbulent because one
25 assumption for this verity (phonetic) of test results,

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1 because it varies in between 0.8 and 1.2; it could be
2 1,000 square foot. One idea was, yeah, it's a test
3 method. How you bring it to the screen with a shovel
4 or with distill or whatever, and we did all kinds of
5 things.

6 One thing we did, we put the plate in the
7 test loop just before the screen, and the plate had
8 only an opening of about 50 millimeter and all of the
9 water had to go through this, which created this roll
10 of turbulence, and then our example -- oh, this will
11 make a lot of bypass, and then we did the other
12 extreme. We allowed sedimentation. We did nothing.
13 We just filled in the fiber and weighted what happens.

14 And to our surprise, the result was
15 exactly the same. My interpretation is what makes the
16 bypass is what comes to us. It means that the
17 smallest and lightest part which can swim best, they
18 make it at first as a strainer, and this kind of
19 debris bed is not yet developed and they make it
20 through. And after that bigger pieces are coming.
21 Normal fibers are coming, and then this stuff develops
22 a debris bed and the bypass stops.

23 CHAIRMAN WALLIS: It's just the initial
24 effect. It doesn't matter how thick it gets after
25 that.

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1 MR. ZIEGER: No.

2 CHAIRMAN WALLIS: It's just the very, very
3 initial effect. It makes sense.

4 MR. ZIEGER: Yes.

5 CHAIRMAN WALLIS: It might even be
6 predictable.

7 MR. ZIEGER: Yes.

8 MEMBER KRESS: So the interpretation is
9 you're only going to -- no matter how much debris
10 you're putting in, you're only going to get a certain
11 amount bypassed.

12 CHAIRMAN WALLIS: Unless you put in an RMI
13 to make the holes --

14 MEMBER KRESS: I'm not sure how to
15 interpret cubic feet of bypass debris. How do you
16 measure cubic feet of this stuff collected on that
17 filtermatte?

18 MR. ZIEGER: Of course, what we collected
19 on the filtermatte was not cubic feet because our
20 filter area was much less than 1,000 square feet.

21 MEMBER KRESS: Yes, but what you got is a
22 mass, right?

23 MR. ZIEGER: Right.

24 MEMBER KRESS: Convert that by density to
25 cubic feet? You don't measure the volume. I guess

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1 you could put it at --

2 MR. ZIEGER: No, because we didn't know
3 the density. We know the density for the loose stuff.
4 We know the density for the filter mode itself, and
5 then we used to calculate back to volume. We used the
6 density which we used for the loose stuff.

7 MEMBER KRESS: Okay. I understand.

8 MR. ZIEGER: There is one data point. We
9 have unfortunately only one where we tested with a
10 smaller hole size because one idea was reduce the hole
11 size. This probably reduces the bypass with the
12 square of the hole size because the area goes with the
13 square.

14 That's not what we found. What we found
15 is it was reduced, but unfortunately we have only one
16 data point, and the one data point was done with the
17 same test model like this one, but it is reduced with
18 the linear with the hole size, not with the square of
19 the hole size.

20 MEMBER KRESS: That probably means the
21 debris closed it up a little faster than stopped the
22 stuff with getting --

23 MR. ZIEGER: My interpretation is if you
24 have a smaller hole, you build the bridges a little
25 bit earlier.

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1 MEMBER KRESS: A little faster, yeah.

2 MR. ZIEGER: Okay. Some pictures of the
3 different methods. Yeah, my computer looks better
4 than here. Sorry.

5 Hands job means we put the mixer with the
6 long axis and went into the test lube and zzzzzz,
7 tried to bring it to the strainer. High turbulence
8 flow, that's what I explained before, and here you see
9 it very good what happens. Here's a plate with only
10 a small opening on the bottom, and then it creates a
11 turbulence.

12 And last but not least, and this was
13 really a surprise to us, sedimentation. Here we did
14 nothing, and you see it settles down. It goes only up
15 to here. All the rest is almost free, but the bypass
16 was exactly the same, like on this one. It was a
17 little bit of a surprise, but it was as it was.

18 That's also interesting, I assume. The
19 size of the bypass, we analyzed it. So we took this
20 material, took it away, and put it to Salsa Innotec
21 (phonetic), which is a kind of research facility in
22 our vicinity, and they measured it, and then they made
23 a classification.

24 Class 1 was called from 0.1 to 0.5
25 lengths. It's always the lengths, the fiber lengths.

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1 The diameter is more or less all the same.

2 Class 2 was 0.2 to 1, 1 to 2, bigger than
3 2.

4 What we found is that about two-thirds are
5 smaller than half a millimeter, which is where I have
6 the inches, 0.02 inches. And 90 percent were smaller
7 than one millimeter, 0.04 inches, and I think because
8 the whole reason why we did this is to find out what
9 is the bypass doing with the downstream equipment,
10 like fuel, like -- I don't know what -- strainers and
11 stumps (phonetic), et cetera.

12 I can imagine with this small particle
13 size is probably not really critical for downstream
14 equipment. I don't know. I'm not a fuel designer, of
15 course, but just an assumption.

16 CHAIRMAN WALLIS: So this is an initial
17 shock, that you would not want to back flush the
18 filter because when you clean it, you get that new --

19 MR. ZIEGER: You create your bypass again.

20 CHAIRMAN WALLIS: Yeah.

21 MR. ZIEGER: That's also the reason why I
22 think, yeah, some systems which are moving
23 continuously are difficult.

24 CHAIRMAN WALLIS: About, yeah, right.

25 MR. ZIEGER: Okay. I think I already

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1 mentioned this during my discussion. That's what you
2 saw in this diagram, above about a quarter of an inch
3 equivalent fiber bed thickness. The bypass is more or
4 less constant.

5 Size of perforation has more or less a
6 linear influence. The test procedure does not really
7 hardly influence what comes out, and of course, I'm
8 always talking about bypass. I'm not talking about
9 head loss here.

10 And that's also a conclusion, and we made
11 other tests. The test I showed you was always at the
12 same flow with the same approach velocity.

13 Of course, we did other tests with varying
14 flow. That means approach velocity, and with approach
15 velocity or with a higher flow, the delta P, the head
16 loss varies.

17 And the conclusion was out of this testing
18 -- unfortunately I don't have a diagram to show the
19 data points, but to reduce the bypass, the reduction
20 of the screen size is not the best idea because due to
21 the smaller screen your flow is constant. The water
22 flow is given. The licensee tells us how much water
23 he has to feed to his reactor. So water flow is
24 given.

25 But if you reduce screen size necessarily

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1 you reduce the water velocity because the flow has to
2 go through a smaller area. So you increased water
3 velocity, which increases head loss, which increases
4 bypass more proportional or over proportional.

5 That means our observation was if you
6 reduce screen size you get even more fiber. Of
7 course, you have to test with the same amount of
8 water. So if you reduce the screen, we have to
9 increase the flow to have sustained situation.

10 If you keep the flow, then it's clear.
11 Then you reduce it. It's a simple thing, but that's
12 not reality. In reality if you reduce the size, you
13 have to increase flow, and this makes it even worse.
14 That was at least our observation. I don't know if
15 somebody else made different observations, but we did
16 this because one argument was, okay, then let's reduce
17 the screen size. No, it doesn't work.

18 And this you have seen. The size of
19 (unintelligible) the screen is small.

20 Chemical. Some chemical tests. Of
21 course, it is a different issue, and I must say I'm a
22 mechanical engineer. I'm not a chemist, and for this
23 chemical test we need a lot of advice from chemical
24 people, and if you ask me something about how they
25 made this precipitant and what they mixed, sorry. I

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1 cannot really tell about it, but I can tell about how
2 we make the test.

3 Now, we did small scale and large scale
4 test with chemical precipitates because these tests
5 were done already about three months ago. It was not
6 done at that time on our multi-functional test loop
7 because this was not available at that time.

8 CHAIRMAN WALLIS: Now, number two is very
9 important. The chemical particulate generator is the
10 loop itself.

11 MR. ZIEGER: Yes.

12 CHAIRMAN WALLIS: The chemical reaction is
13 happening in your loop.

14 MR. ZIEGER: Yes.

15 CHAIRMAN WALLIS: You're not putting in
16 this artificial --

17 MR. ZIEGER: And that's also the reason
18 why we need the experts, because we didn't want to put
19 some strange things in our loop without knowing what
20 happens or you'll get chemical reactions. You'll get
21 changes in temperature. It gets warmer. It's heated
22 up a little bit, not significantly, and therefore, we
23 needed advice from specialists, and they tested it
24 before, outside the loop where they put the stuff
25 together and look what happened and how much falls out

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1 and how much you need to create so many and so on.

2 And then we use these data which were
3 generated by the experts and put the chemicals
4 directly into the loop. Those precipitates were
5 developed in the loop.

6 And of course, because of these
7 chemicals --

8 CHAIRMAN WALLIS: You run it for a whole
9 year to find out what happens.

10 (Laughter.)

11 MR. ZIEGER: No.

12 MEMBER KRESS: They drop the temperature.

13 MR. ZIEGER: We run it longer than usual
14 for a head loss test, but of course --

15 CHAIRMAN WALLIS: Well, this is an
16 interesting question though. The chemistry depends on
17 the temperature, and your temperature is low.

18 MR. ZIEGER: Yeah.

19 CHAIRMAN WALLIS: Okay. Yeah, how you
20 have two scaling factors. This is the usual scaling
21 factor which has to do with the screen size, flow
22 rate, and the other debris like particulate fiber, et
23 cetera, but for the chemicals, of course, you have to
24 take into consideration that test bed volumes to reach
25 the same concentrations like you have in the plant.

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1 So these are two different scaling factors.

2 And of course, both have to be met. So
3 the flow rate is given by the geometry, and then the
4 amount of chemicals which are added to the loop are
5 given by special volume and necessary concentration.

6 And then what I explained also, all of the
7 chemical experts from Salsa Innotec did a lot of
8 investigations before they could start with the test.
9 For example, they looked at the influence of tap water
10 compared with the real water chemistry because we
11 cannot test this reactor water with all of these
12 ingredients. So we are using as a basic fluid, of
13 course, tap water, and then they looked at this
14 influence.

15 And so the outcome of this investigation
16 was we can use tap water. We don't have to use the
17 de-ionized water with all of these chemistries.

18 Then surrogate material. As I mentioned
19 before, we use only one. We use only this stone flour
20 as a surrogate for painting, and they also looked at
21 this and they compared it, how it dissolved in boric
22 acid, and the outcome was the same. It's usable.

23 Then with integral chemical tests we mean
24 all what was needed to create the precipitates we
25 wanted to have based on this other medium, and these

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1 were several chemicals. I think five or six or seven.
2 All of this was put into the test loop during the
3 circulation with a very straight order. They told us
4 exactly at this time you have to put in this and this
5 amount and 20 minutes later this and this and that,
6 and we were also all the time under observation of
7 this chemical guise.

8 Yeah, and what they did in their
9 laboratory, for example, mixing before we did the test
10 because the test is relatively expensive if you bill
11 this whole pool, and if it doesn't work, you waste a
12 lot of money. If the ingredients really mix together,
13 if it works, they found out how many of these
14 chemicals they had to put together to get this other
15 medium precipitant which we wanted, and so we played
16 with the pH barrier, viscosity.

17 That's the loop again, but that's a
18 picture for all future chemical tests. As I said,
19 this test we are talking about, although I will give
20 you some results was made on our large scale test
21 loop, but all that are coming now will be done here,
22 and this with the function test loop, and I already
23 explained the test model here.

24 The plate to create vertical flow because
25 in one of the locations of the customer we have a wall

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1 relatively close to the strainer, and then this is
2 almost filled with debris or with RMI, and of course,
3 it's a different if the water can come from here or if
4 it has to go down all the way to the bottom of the
5 strainer that we built in this.

6 And here is a kind of -- I don't know how
7 to call in English -- a kind of rectifier kind of
8 mixing plate to create a turbulent flow after that one
9 year to guarantee a good mixing.

10 So these are some data. That's a fail to
11 surface approach velocity, and with fail to surface I
12 mean the whole surface, the whole pocket area. That
13 was 0.0117 foot per second.

14 The fiber loading or the debris loading,
15 it was like you see here. It was fiber, Transco stuff
16 and glass fiber, but it was also zinc dust and this is
17 the surrogate that we are using, stone flour, and it
18 was RMI.

19 And the equivalent fiber bed thickness was
20 about 0.05 inch, which is not very much, and the test
21 was performed at ambient temperature. This is the
22 text matrix. All of this here is chemical stuff.

23 CHAIRMAN WALLIS: I'm surprised by the
24 amount of zinc dust. Is that a right number, a
25 correct number? The zinc seems to be the biggest

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1 component strain.

2 MR. ZIEGER: Yes. That's why in this case
3 for this plant it is the case. It is the biggest
4 thing, the zinc dust, and when you actually circulate
5 it when you do the test, the water is almost gray
6 because the zinc dust is very fine stuff, and with
7 this testing you never get this if the circulating
8 more or less continues.

9 And then some of the results. This was a
10 test which has the same debris and the same chemicals
11 like these two tests. The only difference between
12 these two lines and the red line is here we put all
13 together or we put the RMI together with the rest of
14 the debris. So these are viable with the same test.
15 Altogether was mixed and put not, of course, at once,
16 but mixed batch by batch into the loop.

17 The side is this, and you see the increase
18 in head loss due to chemicals because this is without
19 chemicals here, zero, and this is with what they call
20 140 percent. One hundred percent is what they really
21 expect in their plant, and of course, nuclear, all
22 kinds of activity, that's clear you always do more
23 than you have to do. So we tested up to 140 percent.

24 CHAIRMAN WALLIS: Excuse me. Does this
25 pressure drop change with time as the chemical

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1 reactions happen or is this -- this is some time
2 you're plotting here presumably.

3 MR. ZIEGER: No, that's not the time here,
4 but --

5 CHAIRMAN WALLIS: No, no, no. But this
6 must be some time after putting --

7 MEMBER KRESS: Each point, each point must
8 be here.

9 CHAIRMAN WALLIS: Does everything come to
10 some equilibrium or what has happened?

11 MR. ZIEGER: What we did, we had a certain
12 criteria. How long we waited to put the next batch --

13 CHAIRMAN WALLIS: Is a termination
14 criteria.

15 MR. ZIEGER: A termination criteria.

16 CHAIRMAN WALLIS: Something is leveled
17 off.

18 MR. ZIEGER: And this was for this test,
19 was relatively strict. As far as I remember, it was
20 at two percent per hour, which means one percent per
21 30 minutes.

22 CHAIRMAN WALLIS: Nothing much is
23 happening.

24 MR. ZIEGER: Yeah, and then when it was
25 stabilized, we put in the next batch, and then it

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1 makes -- it takes some time until it arrives, et
2 cetera, but then it goes up.

3 Okay. Now I might say it was not really
4 a surprise that this line was so low because RMI makes
5 mainly porosity, and porosity is good.

6 MEMBER KRESS: So RMI is helpful, right?

7 MR. ZIEGER: Yeah. Then we did another
8 test, and this test was not with chemicals. That's
9 why it is here on the zero line. We wanted to find
10 out what is more conservative, the original paint
11 stuff or the stone flour. For this test we used
12 original stuff, and these are the two data points.
13 The lower one is without RMI. The bigger one is with
14 RMI. And the green ones are with surrogate, and as a
15 conclusion for the chemical tests number three, four,
16 five we used this surrogate material because it was
17 conservative, because higher than the original one.

18 And a surprise again, but not really a
19 surprise, here we have again such bore hole effect.
20 Without RMI we were here. After adding the RMI, we
21 measured the lower head loss.

22 Here it was the opposite, and here, here,
23 and here the RMI was added at the end. This test
24 number four was done without RMI. So up to here it
25 was exactly the same, but for test number five, we put

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1 the RMI on top of it, and in this case it increased
2 the head loss.

3 But I think what this curve shows us, it's
4 a relatively good repeatability of statis -- of
5 course, they are not exactly the same, and I think
6 there are a lot of influences in how it distributes
7 and the strainer itself. It's more or less by
8 accident, but it's a fairly good repeatability, I
9 think, and especially -- of course, it's by accident,
10 I think -- but if you look at the 100 percent point,
11 it was exactly the same for both tests, the 100
12 percent chemicals and the head loss increased from 1.7
13 foot water column to about 2.2.

14 Of course, if your allowable is here, that
15 is a significant thing, but usually the allowable is
16 somewhere up there, and then I would say it's not
17 really critical. It depends very much on what you
18 have available.

19 It is an increase of about how much is it,
20 1.2 to 2.2? That is about 40 percent or so, but
21 compared with a lot of it, it was not critical. And
22 due to the huge amount of RMI, as I mentioned, the
23 strainer, again, is fully submerged under the RMI, and
24 here's a test model that was removed, and you see a
25 lot of RMI inside the pockets.

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1 And this test was a test without RMI. The
2 quality of the picture is not so good, but here you
3 see all of these it looks like -- I don't know -- like
4 dust mat. It looks very muddy there inside.

5 Okay. Some conclusions, but due to the
6 very limited number of tests, these conclusions might
7 be a little bit of speculation.

8 this statement, of course, has very much
9 to do with what you have available. What is your
10 allowable NPSH? In this case allowable was far away.
11 We could state it's not significant, but it was a 40
12 percent increase. So it can be significant. It
13 depends very much on your situation.

14 Repeatability at least for the two tests
15 which we did was exactly the same condition, the same
16 flow, the same debris, the same chemicals.
17 Repeatability was, in my opinion, good, and that's
18 also not a big surprise. If fibers and particulates
19 are -- sorry -- and RMI is mixed, you will reduce your
20 head loss, but I think that that's more an ideal role,
21 but I can imagine a reality in the plant. At first
22 the fiber comes because it swims best, and at a very,
23 very late point in time maybe some RMI is coming. I
24 think this situation you will probably not have in
25 reality in the plant.

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1 Debris preparation methodology,
2 fiberglass, transfer mat, stone flour, zinc filler,
3 and RMI.

4 We do at first -- the pictures are not
5 very nice in quality -- we do at first mechanical,
6 mechanical -- how do you call? -- dispulsion
7 (phonetic). We put it in a leaf shredder, you know,
8 what you use in your garden. Put it and double it and
9 then it comes out, and then after shredding it, we
10 put it with the watershed, with the high watershed.

11 We mix it until it looks like this, but we
12 don't cook it. We didn't -- up to now we didn't cook
13 the fiber and the Transco material.

14 I don't know if cooking is really needed.
15 It was always agreed with our licensee because they
16 know our procedures. They know the specification. We
17 do it that way, and it results into very fine stuff.
18 I think proof that it is very fine was our analysis of
19 the bypass, with most of the materials smaller than
20 one millimeter.

21 That's the same for (unintelligible) for
22 the Transco material after treating with the
23 watershed, and that's the RMI. Okay. That's more or
24 less crunched.

25 CHAIRMAN WALLIS: That's in a leaf

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1 shredder, too, or something else?

2 MR. ZIEGER: That is a kind of leaf
3 shredder, too, yeah, and in the beginning we cut it
4 more or less with a kind of knife and then some people
5 were fitting it, and then we found the company who
6 does it for us in a kind of leaf shredder.

7 It's not really a leaf shredder. It's a
8 little bit different device, but it makes these kind
9 of pieces, and then what we also do, we sort them by
10 size so that we don't have only big ones. We have a
11 certain mixture between big ones, smaller ones,
12 smaller ones.

13 So briefly in production methodology was
14 already mentioned. Simultaneously, which means accept
15 with IV plate. Usually we put it in at the end, which
16 is probably closest to reality, but all of the rest,
17 zinc dust or particulates, et cetera, are mixed in
18 batches and then put into that, in batches mixed
19 already, except the chemicals. The chemicals I
20 explained before. Chemicals were put in after the
21 debris was put in.

22 Now, this tends to lead to the closest
23 uniform, but uniform can never be reached with the
24 vertical. It is always done with a test
25 configuration.

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1 And debris settling not credited, it was
2 all the wish of our customer or the licensees to be
3 conservative. As I told you several times, we dump it
4 directly in front of the strainer.

5 Now we do some tests for another customer
6 to find out what the transportation mechanism really
7 is.

8 So I think that's all. That's my last
9 slide.

10 Termination criteria, that was not the
11 simplest thing up till now because everybody had a
12 little bit different idea how they want to have it.
13 What I deleted here are all of the different
14 customers. These are all different tests for
15 different customers, and we have really a huge variety
16 of termination criteria. I think the most complicated
17 is this one, which means as long as the head loss is
18 in a band between zero and half a feet, to go to the
19 next step of testing we waited 20 minutes and maximum
20 change was six percent. Then for the next step of
21 head loss, half an inch to one inch. Again, six
22 percent, but the time was double. That means this is
23 an early quote which gives you really a comparison
24 that is percentage per hour.

25 then it went down to nine percent per hour

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1 change or gradient, and finally when the head loss
2 reached one foot and the buff determination for the
3 area was two percent per 60 minutes or one percent for
4 30 minutes, but two percent per hour.

5 but you see it varied. It was different.
6 We mainly did what our customer asked us to do, but I
7 think for future testing and for the normal functional
8 test loop, we will use -- if we can choose
9 determination criteria, we will go to the quantity of
10 one or two percent per hour.

11 CHAIRMAN WALLIS: I think the only problem
12 with termination criteria may be with some of the
13 chemical effects tests where some chemical effects
14 take time to develop. Otherwise it's probably okay.

15 MR. ZIEGER: Okay.

16 CHAIRMAN WALLIS: Thank you very much.

17 MEMBER MAYNARD: Your modules, once
18 they're installed, are they permanent or can they be
19 removed if you need access for maintenance or --

20 MR. ZIEGER: yes, they can be removed.
21 It's a modular design, and the modulars could be
22 removed, but this takes more effort because you have
23 to disassemble it, but the cartridges, we call it the
24 cartridge. A cartridge is two rows of pockets in one
25 piece, and you can handle it without any crane or any

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1 additional device. Maximum weight is about 40 kilos
2 or 80 pounds, and this can be removed by hand, and
3 then you get Xes, for example, to this channel. Then
4 you could inspect inside the channel if needed or if
5 you need Xes to your Section 9, whatever. It can be
6 removed without cutting or without reevaluating. It's
7 only assembled.

8 MEMBER BONACA: Well, they must be
9 protected from blow-down, I mean.

10 MR. ZIEGER: Yeah. It depends also very
11 much on the situation in the plant. Sometimes we have
12 a kind of roof covers this strainers for protection if
13 something comes from above, for missile, missile
14 protection.

15 MEMBER BONACA: Yeah, or blow-down during
16 a LOCA.

17 MR. ZIEGER: Yeah. But it depends very
18 much where this -- of course inside the strainer we
19 don't have this, and with one installation, but in the
20 other installation where it goes a little bit around
21 the containment, we have a kind of roof on top of it.
22 It depends.

23 CHAIRMAN WALLIS: Everyone is looking at
24 me.

25 MEMBER KRESS: Well, you're the man.

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1 PARTICIPANT: You're the man with the
2 gavel.

3 MEMBER KRESS: You're the man with the
4 agenda and the gavel.

5 CHAIRMAN WALLIS: We're going to take a
6 break if there's no more presentation. Are you going
7 to make anymore presentation or this is --

8 MEMBER KRESS: That was it.

9 CHAIRMAN WALLIS: Finished.

10 MR. ZIEGER: That was all that I prepared.
11 I can --

12 CHAIRMAN WALLIS: That's fine.

13 MR. ZIEGER: I can talk another three
14 hours about that if you want.

15 (Laughter.)

16 CHAIRMAN WALLIS: Does the committee have
17 any desire to ask anymore questions or more
18 explanations?

19 MEMBER BONACA: It was informative.

20 MEMBER KRESS: I thought it was very clear
21 and informative. Thank you very much.

22 MR. ZIEGER: You're welcome.

23 CHAIRMAN WALLIS: Thank you.

24 Well, now we're ready to take a break,
25 take a break 15 minutes.

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1 PARTICIPANTS: 20 minutes.

2 CHAIRMAN WALLIS: Well, let's come in at
3 10:30 then. Ten, thirty is easy.

4 MEMBER KRESS: Yeah.

5 CHAIRMAN WALLIS: Ten, thirty is still
6 ahead of schedule. So we'll break until 10:30.

7 (Whereupon, the foregoing matter went off
8 the record at 10:06 a.m. and went back on
9 the record at 10:34 a.m.)

10 CHAIRMAN WALLIS: We're not going to hear
11 from the ACL about their work on strainers, and we're
12 looking forward to it. So please go ahead.

13 MR. FISHER: My name is Nigel Fisher. I
14 am the testing lead on the CLO strainers, and with me
15 I have Dr. Dave Guzonas, who is a reactor chemist, who
16 is going to be helping me out when we get to chemical
17 effects test.

18 We're following the same outline that the
19 other vendor followed. We'll give a discussion of the
20 scaling methodology, how we prepared debris, how we
21 introduced debris into the test sections, what we're
22 planning to do on chemical effects because we have no
23 started the chemical effects testing yet, what we've
24 done on bypass testing, what the determination
25 criteria is for head loss test, and --

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1 CHAIRMAN WALLIS: Where does this term
2 come from? Does it come from the NRC?

3 MR. FISHER: The termination criteria?

4 CHAIRMAN WALLIS: Yes.

5 MR. FISHER: I don't know. I guess the
6 NRC is going to --

7 CHAIRMAN WALLIS: Universal.

8 MR. FISHER: -- various standards.

9 DR. LU: Shan Lu with ESS.

10 One of the issues we raised there, you can
11 express our expectation during our meeting with NEI.
12 That's right.

13 CHAIRMAN WALLIS: Thank you.

14 MR. FISHER: And then I'll show you some
15 jobs in what we call our reduced scale facility and
16 some results from what we call our large scale
17 facility.

18 First of all, I'd like to spend a few
19 minutes on the concept of our strainer. Our strainer
20 is what we termed a thin strainer. The straining
21 surface is sets of fins and they are attached to --

22 CHAIRMAN WALLIS: Presumably two-sided
23 fins?

24 MR. FISHER: That's right. Two-sided
25 fins. Each side is perforated metal, and the fins are

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1 attached to a collection header which then meets into
2 the plumb.

3 So it's a modular design. We customize
4 the size of the fin and the pitch of the fin for the
5 various applications, and fins can be horizontal as
6 those are or vertical.

7 We have a model here. I'll show you some
8 features of it. This is a mock-up, an instrumentation
9 of a horizontal fin. So it's two pieces of
10 corrugated, perforated metal, and corrugated to
11 increase the surface area, and so the water comes in
12 on each side of the fin and then flows through the
13 channels that are formed by the corrugations, and the
14 corrugations also give us strength to resist collapse
15 of the fin.

16 And then we have end caps at the end where
17 it goes into a header, and then there are orifices in
18 the header to balance the head loss, a key strainer
19 condition to have the same water entry in the fin
20 that's furthest from the pump as entry to the fin
21 that's closest to the pump.

22 Once the fins are attached into the
23 header, then there are structural ends on the ends and
24 tops of the fins to give the structure resistance to
25 hydraulic loops. We have to pull the fins in place

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1 during seismic events. That's always the challenge.

2 We test in two facilities, in Chalk River
3 and Ontario. We have what we call a reduced scale
4 facility and there we test a section of two or three
5 fins. They are full sized fins, but we call them a
6 reduced scale because we're only logging two or three
7 fins for the whole strainer.

8 We do testing here if we want to try to
9 optimize the strainer area, optimize the fin pitch,
10 and that's where we plan to do our chemical effects
11 testing.

12 By optimize strainer area, it's
13 essentially a head loss test. For us it's looking at
14 the thin bed head loss to determine how much area we
15 need.

16 MEMBER KRESS: Fin pitch, that's the
17 spacing between the two plates?

18 MR. FISHER: That's right. The fin pitch
19 is the spacing, and there we're controlled by the full
20 debris load. You want the fins far enough apart that
21 we have the interstitial volume to accommodate all of
22 the fiber. We don't have too much encapsulation. We
23 do allow encapsulation to a certain degree.

24 Then our large scale facilities are really
25 for proof testing for each customer, and there we test

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1 a whole module, which would be typically between eight
2 and 16 fins. So it's really just a larger scale
3 version of the reduced scale facility.

4 MEMBER KRESS: Is CANDU a head loss
5 problem.

6 MR. FISHER: Yes. We installed this type
7 of strainer. So rather than being corrugated, they
8 were flat plates at that point and call of the CANDU
9 reactors in the late '90s and early 2000 brought that
10 up. The CANDU industry is looking at right now though
11 chemical effects. That was not addressed the first
12 time around, and so David here is doing work on the
13 chemical effects for CANDUs.

14 This is a photograph of the reduced scale
15 facility. It's essentially a plastic tank about 90
16 inches diameter, and you see a test module sitting in
17 there, which is three fins attached to a collecting
18 header, and these fins are actually modeling the RS
19 portion of the Surry strainer for Dominion
20 (unintelligible) Surry plant, and here the fins are
21 about 30 inches long and about 12 and a half inches
22 high.

23 And there are three fins, but the
24 straining area we're modeling is that of two fins.
25 The center fin has perforated material on both sides,

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1 whereas the two outer fins are only perforated on the
2 inside surface. So it is two fin spaces of a model.

3 We make every attempt to get all of the
4 debris introduce into this tank on the strainer. So
5 we have a stirrer that is knocked on the side of
6 the --

7 (Short loss of electronic transmission.)

8 MR. FISHER: So we put baffles around the
9 strainer itself.

10 This is a thin bed test. So we have a
11 baffle at the back of the header so the curve of the
12 flow doesn't sweep under the header and come up
13 against the fins, and then we have baffles on each
14 side of the outer fins. So, again, just so we don't
15 get turbulence flow coming under the test section.

16 And then we have a baffle at the front of
17 the fin so that we don't have turbine eddies come in
18 the front spaces.

19 So the fin test, the flow path into the
20 fin spaces is either from the top or it can come in
21 from the sides because there the baffles are an inch
22 or two back from the side of the fin.

23 CHAIRMAN WALLIS: Well, this is somewhat
24 unrealistic. In the plant either you have turbulence
25 or you don't, and you don't have these baffles, do

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1 you, in the plant?

2 MR. FISHER: That's right. Yeah, the
3 baffles are to give us laminar flow close to the
4 strainer. The turbulence is to --

5 CHAIRMAN WALLIS: It's a mix, but in the
6 plant you won't have all of those conditions at the
7 same time. You might have turbulence or you don't,
8 and if you have it, then the baffles aren't there. So
9 presumably --

10 MR. FISHER: You don't expect to have
11 turbulence in the plant. the purpose of turbulence is
12 just to stop settling of the debris.

13 These are the characteristics of that
14 facility. It's 1,500 gallons. It's a simple nuke.
15 We operate up to just under 100 gallons per minute,
16 and we can work up to 120 Fahrenheit. We use service
17 water, which has a little bit of suspended solids in
18 it when we get it, and as I said, we use a stirrer to
19 mix the water, keeping turbulent conditions to
20 maintain the suspension of the debris.

21 We have two large scale facilities.

22 CHAIRMAN WALLIS: Is it true that the term
23 "crud" means Chalk River unidentified debris? Is that
24 true?

25 MR. FISHER: We'd like to think that.

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1 (Laughter.)

2 MR. FISHER: I don't know if it's true,
3 but it's certainly written down at Chalk River that
4 it's true. We don't have crud in these tests, I hope.
5 Well, I guess we do really.

6 We have two large scale facilities. We
7 call them Rig 42 and Rig 85. The difference is that
8 85 is taller, which we have built to test taller
9 strainers.

10 The test section that's installed in Rig
11 42 on the left is a large scale model of the Millstone
12 2 strainer, which would be a horizontal strainer with
13 fins that are about four feet long and three feet
14 tall.

15 MEMBER KRESS: They look like --

16 MR. FISHER: Sorry?

17 MEMBER KRESS: It looks like a large pitch
18 on those.

19 MR. FISHER: Yes, it is. It's a ten inch
20 pitch. It's also with all of the fibrous debris. So
21 we have a big spacing on the fence.

22 And here we have baffles at each end of
23 this module to simulate the position of the next fin
24 on the next module. Because we want all of the
25 fibrous debris we had in here to have to pack into the

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1 area of the one module.

2 On the left we have a vertical type
3 strainer there for one of the French plants. So there
4 the flow once it gets into the fin is down into a
5 header that's on or a plenum that's on the floor and
6 then across the sump pit where we are doing a similar
7 thing for Millstone 3.

8 Here are the characteristics of these two
9 rigs. Sixty-five hundred gallons and 8,000 gallons,
10 respectively, but issued the same way. Higher flow
11 rates, the same temperature ranges, and originally the
12 same water.

13 CHAIRMAN WALLIS: I'm assuming the water
14 temperature in the room doesn't get to 120.

15 MR. FISHER: No. We have heaters to heat
16 it up and cool it. At this time of year it's not bad.
17 You bring the water in at about 60 Fahrenheit and heat
18 it to about 204 Fahrenheit. In the winter you could
19 bring it in in about 40 Fahrenheit and have to heat
20 for overnight to get it up to 104 Fahrenheit. So our
21 tests are going faster now than they were in
22 wintertime.

23 Here's the forward yield of the licensees.
24 We have two U.S. clients, Dominion where we have six
25 plants, four designs. The Surry plants will be very

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1 close to each other and so will North Anna, and we're
2 also putting in a strainer for South Carolina Electric
3 and Gas, the VC Summer plant.

4 The RS means that we're doing reduced
5 scale testing. So Dominion has chosen to do reduced
6 scale testing to try and make the strainer smaller
7 than were originally predicted by using NUREG
8 calculations, and so we've first of all used the
9 testing to try to remove any conservatism that was in
10 NUREG, and then where that still doesn't get it down
11 small enough to show that removing various types of
12 debris, the more difficult particulates like calcium
13 silicate or microtherm to reduce the strainer even
14 further.

15 And so we finished that sort of testing
16 for Millstone 2 and for the Surry design. We are
17 currently doing North Anna testing, and we will be
18 doing Millstone 3 testing in September.

19 VC Summer has chosen not to do that sort
20 of testing. We are going directly into the proof
21 testing in the large scale facility. There we're
22 using a strainer which is the largest that could fit
23 within their pit, which is slightly larger than the
24 NUREG size.

25 We've done large scale testing for

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1 Millstone 2. Next month we'll be doing Surry, and
2 then the following month Millstone and North Anna.

3 Chemical effects testing. We're going to
4 start some benchtop testing in the next few weeks and
5 get into chemical effects testing in the fall and then
6 fall off in the winter.

7 We have down there that chemical effects
8 testing is not required right now for VC Summer, and
9 that's based on computations that Dave has done for
10 the amount of chemical precipitates that are predicted
11 to be present in VC Summer. It's a very small amount,
12 and we hope to be able to show with debris testing
13 that we don't need to do chemical effects testing for
14 VC Summer.

15 However, if we show this small amounts of
16 precipitates do cause a larger pit, then we'll have to
17 reconsider that decision for VC Summer.

18 Here's an overview of the design
19 parameters. So all of the Dominion plants are mixed
20 fiber and particulate beds. Surry has very little
21 fibers, mostly particulate. North Anna has a large
22 both. Millstone 2 was heavier on particulate but a
23 lot more fiber than Surry, and Millstone 3 is sort of
24 in the middle ground as well. VC Summer is an RMI
25 plant with a very small amount of fiber.

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1 The hole size that both clients wanted was
2 one-sixteenth of an inch. So that's what we're using
3 for their designs. We used one-eighth of an inch for
4 the CANDU industry and three-thirty-seconds in France
5 because, in general, there has been a drive by clients
6 down in hole size for time.

7 The available NPSH margin as shown there
8 is really the allowable. That's how much of the
9 larger --

10 CHAIRMAN WALLIS: Do you still use these
11 English units in Canada?

12 MR. FISHER: No, we don't. So that's why
13 you'll see in the last column I have approach
14 velocities, and they'll be in meters per second
15 because I can understand that a lot better than the
16 feet per second.

17 Yes, so we're bilingual on units as much
18 as possible.

19 And you can see that the strainer areas
20 are quite large, and that's because they're being
21 controlled on area by a thing bed effect that we're
22 observing. The ones that don't have the approximation
23 sign in front of them are the decision has already
24 been made that that will be the size.

25 And then on top of what's there will be

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1 also some additional area, a sacrificial area for
2 labels and text. The ones that still have the
3 approximate size, that's what NUREG is saying the size
4 will be, and we have to confirm that by testing.

5 CHAIRMAN WALLIS: Stainless steel?

6 MR. FISHER: They're all stainless steel.

7 CHAIRMAN WALLIS: I guess that's true of
8 all manufacturers.

9 MR. FISHER: I think so. So we're really
10 increasing the price of stainless steel because we're
11 sucking it up around the world, I think.

12 The approach velocity is of interest in
13 the last column. You'll see with Millstone 2, which
14 I'll show you some results from later, has a lower
15 approach velocity than Surry, and we see the effect of
16 that in how thick the thin bed is. We find that with
17 lower approach velocities, it takes more fiber to form
18 the thin bed than with high approach velocities.

19 These are some pictures of the reduced
20 scale test sections. On the left we have the section
21 for Millstone 2, and that's in a thin bed test result.
22 You can see there's a brown thin layer covering, all
23 of the thin surface, and it's about a quarter of an
24 inch thick. It's thicker on the top of the accordion
25 section due to gravity, but we still do get sticky to

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1 the bottom because of the flow of water coming in.

2 And then on top of that, you can see some
3 patches of yellow. Those are additional fiber deposit
4 after we had already formed a thin bed. So we're not
5 picking up any particulate in that additional fiber
6 addition, and so the stain yellow.

7 The one on the right is Surry. There
8 because we need a very large surface area and there's
9 very little fiber in the plant, we've put the fins
10 very close together. The pitch is four inches. So
11 it's a two inch space, and the test there is both a
12 thin bed and a full debris test all in one.

13 The first report on the thin bed and then
14 we add in the additional fiber until all of the fiber
15 is present. So you can see that with this technique
16 of stirring the water, and we also brush the bottom
17 during our full debris load test to try to maximize
18 the settlement of debris on the test section rather
19 than on tank bottom. We are getting the majority to
20 settle on the test section.

21 We get more to settle on the Surry test
22 section. I believe that's because it's a higher
23 approach velocity than for Millstone 2.

24 We use the same scaling methodology that
25 all of the vendors are using, which is we adjust the

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1 available head loss by the ratio of the dynamic
2 viscosities of our test temperature and sump
3 temperature to give us what we call viscosity
4 corrected allowable, and then we compare our test
5 results to that viscosity corrected allowable.

6 CHAIRMAN WALLIS: Presumably when you heat
7 the water, sometimes air is involved, is it?

8 MR. FISHER: That's right. Especially in
9 the winter, a lot of air comes out of the water. So
10 as our heating procedure, we overheat by 10 degrees
11 Celsius and then we back that off so that we're below
12 the saturated gas conditions. Otherwise gas bubbles
13 will tend to (unintelligible) large solution and --

14 CHAIRMAN WALLIS: If you have enough
15 pressure drop in the screen, you can get bubbles in
16 there.

17 MR. FISHER: Yeah, that's right. Even
18 with a low pressure drop as it squeezes to go through
19 the hole you get bulk coming out, and that can knock
20 off fiber and you can't pour it through that because
21 the air bubbles are not enough.

22 If the vendor, if the clients could
23 actually use that as a way of keeping their --

24 CHAIRMAN WALLIS: That works when it's a
25 thin bed. If you have a thicker bed and you start to

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1 get bubbles, then it actually can lodge inside the bed
2 and increase the pressure drop.

3 MR. FISHER: Yeah, I guess it can
4 become --

5 CHAIRMAN WALLIS: Stuck in the middle
6 itself.

7 MR. FISHER: The particular problems we
8 had before we started, overheating and cooling,
9 especially in wintertime, was that the initial fiber
10 deposits would start to collect and the air bubbles
11 would form.

12 CHAIRMAN WALLIS: And they would get
13 buoyant, and then they would go to the top and the
14 bubble bursts and they fall down again.

15 MR. FISHER: Yeah. You'd come in and all
16 of your fiber was floating whereas before it was on
17 the thin.

18 CHAIRMAN WALLIS: So if you have chemical
19 reactions in there that make bubbles then this would
20 also happen.

21 MR. FISHER: That's true.

22 Here's the other case where rather than
23 being a thin bed we have a four degree load. Here we
24 do allow in some designs some level of encapsulation,
25 and so that encapsulation forms a bridging layer on

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1 top of and in front of our vents.

2 And here we get head losses that are
3 greater than what NUREG would predict for this
4 condition because of the encapsulation effect, but
5 this is not the controlling case for our area. So
6 head loss --

7 CHAIRMAN WALLIS: NUREG would predict if
8 you used the full area of the screen.

9 MR. FISHER: That's right.

10 CHAIRMAN WALLIS: So encapsulation is your
11 term for circumscribed.

12 MR. FISHER: That's right. But on the
13 left is Millstone 2 and on the right is North Anna.
14 For Millstone 2 we're allowing a layer of up to six
15 inches height to form on top of it, whereas for North
16 Anna we're allowing a layer of about three inches
17 height.

18 CHAIRMAN WALLIS: What is that, something
19 floating on the left there or what is that?

20 MR. FISHER: Yes, that is some of the
21 Fibrex debris. Again, we don't boil or bake our
22 debris, and Fibrex narrow wall is very difficult to
23 wet. So that would be skimmed off and re-pressure
24 washed and put back in with the next.

25 CHAIRMAN WALLIS: Okay.

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1 MR. FISHER: So that's a little bit of
2 floating debris there.

3 So debris types. We have RMI in all the
4 plants. At the Dominion plants it's a small amount.
5 In North Anna -- sorry -- in VC Summer it's a very
6 large amount. Transco RMI Foil is what we're using.
7 That's a stainless steel in all cases.

8 For fibers we've been using mineral fibers
9 for Knauf. For Millstone 2, mineral wool, both a
10 Fibrex brand and a Poroff (phonetic) brand, which is
11 a European brand, and various types of fiberglass,
12 Nukon, TempMat, Cerafiber, Thermal Wrap.

13 For particulates, we've come up against
14 calcium silicate, Marinite and Microtherm, and
15 coatings both qualify and unqualified.

16 The surrogates we're using, currently
17 we're using walnut shell flour as a surrogate for our
18 coatings. We started with silicone carbide, and we
19 found that because that particle was so heavy -- it's
20 187 pounds per cubic foot -- it would tend to settle
21 out rather than come to the strainer and be picked up
22 by the fiber. So we could not form a thin bed when we
23 were using silicone carbide.

24 We switched to walnut shell flour because
25 its density is much closer to that of paint. It's 81

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1 pounds per cubic foot, and so it stays suspended much
2 easier and makes its way through the debris bed.

3 For asbestos, we've been using a dense
4 fiberglass. For latent fiber we've been using
5 fiberglass as a surrogate, and for latent particulate
6 we're using walnut shell flour again.

7 A few slides here on debris preparation.
8 These will show RMI being prepared for the Dominion
9 tests, and as the other vendor showed, we make it in
10 various sizes from half inch by half inch up to six
11 inches by six inch, and then it's crumpled.

12 For Dominion where it's relatively small
13 amounts, it's done by hand, but for VC Summer, we've
14 had to go to a mechanical process to do it.

15 So here are some examples of what we're
16 preparing currently for VC Summer.

17 CHAIRMAN WALLIS: Have you heard of this
18 MIN-K stuff?

19 MR. FISHER: I've heard of MIN-K. We
20 haven't tested it as part of the U.S. program. It's
21 similar to Microtherm. It's a microporous.

22 CHAIRMAN WALLIS: Apparently it's pretty
23 potent as a head loss producer.

24 MR. FISHER: Yeah. So is Microtherm. In
25 fact, the Dominion plant that has Microtherm, they're

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1 going to have to take it out in order to have a
2 strainer fit in containment.

3 Here we mechanically crumple by putting
4 the small pieces through a wood chipper and the large
5 pieces through a leaf shredder.

6 Here are some examples of fiberglass.
7 This is after it's being put through a leaf shredder
8 to shred into small pieces. We have Paroc on the
9 left, which is a type of mineral oil, and the Paroc
10 and the Fibrex tend to have a lot of particulate in
11 them. I guess it's from the process in which they're
12 made.

13 We have Cerafiber in the center, which is
14 a fiberglass, and it's like cotton balls. TempMat on
15 the right is another fiberglass, but here the strands
16 are much longer. It's more like horse hair.

17 Later in the process after we wet the
18 stuff, then we use a pressure washer to break the
19 fibers down to smaller clumps and more fibers.

20 Here are some examples of particulates.
21 The walnut shell flour that is purchased in a ground
22 and sized --

23 CHAIRMAN WALLIS: What is walnut shell
24 flour used for normally?

25 MR. FISHER: I'm not completely sure, but

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1 I think it's used as a supplement to soil in some
2 cases.

3 MR. BLEIGH: I think they also use it as
4 like a sandblaster, like sandblasting.

5 CHAIRMAN WALLIS: Oh.

6 MR. BLEIGH: Jim Bleigh with PCI.

7 MR. FISHER: And on the right there is
8 calcium silicate, which has been broken up using a
9 hammer mill to get down to a smaller size.

10 CHAIRMAN WALLIS: Is this the same calcium
11 silicate which is in CalSil insulation?

12 MR. FISHER: Yeah, this is modern CalSil
13 which would have a little bit of binder which is known
14 asbestos, and it's made by Johns-Mansville.

15 CHAIRMAN WALLIS: So it's similar to real
16 CalSil?

17 MR. FISHER: That's right. Because we
18 switched from silicon carbide as our particulate to
19 walnut shell flour, we wanted to do some work on
20 characterizing walnut shell flour. So we have some
21 histograms here of particle diameters that were
22 measured using SEM for --

23 CHAIRMAN WALLIS: The walnut shell
24 presumably has quite different chemistry than these
25 others.

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1 MR. FISHER: Yeah, it's --

2 CHAIRMAN WALLIS: Organic material.

3 MR. FISHER: It's organic, but it's
4 considered inert, and we've done tests to see whether
5 it breaks down over time and found it doesn't in the
6 wire temperatures that we're using, and we've done
7 tests to show that it doesn't clump together or
8 flocculate, and we've done tests to show that it
9 doesn't soak up water with time.

10 And we will have to before we get into
11 chemical effects testing look at the effect of boric
12 acid on it.

13 On these graphs here you can see that
14 material from two different suppliers is quite
15 similar, but the mean size is larger than for the
16 silicone carbide that we are using. You can purchase
17 silicone carbide with a mean of ten microns, ranging
18 from about two to 40 microns. Here the finest mesh
19 size walnut shell flour you can buy; the mean is about
20 20 microns and it ranges from two to 65 microns.

21 I have a couple of slides here on how we
22 introduce debris into the test tanks.

23 CHAIRMAN WALLIS: It doesn't clump up at
24 all in this walnut shell flour? There's no kind of --

25 MR. FISHER: No, we've done tests, beaker

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1 tests, and it doesn't clump up, no.

2 CHAIRMAN WALLIS: Nothing like regular
3 wheat flour then. Wheat flour is terrible. You make
4 flour paste out of it.

5 MR. FISHER: I think that's because the
6 wheat flour is absorbing water, and the walnut shell
7 is not absorbing water.

8 CHAIRMAN WALLIS: Has gluten and stuff.
9 No starch in it?

10 MR. FISHER: Well, it's an organic. So it
11 probably have lots of different things. I don't know
12 what those are, but --

13 CHAIRMAN WALLIS: Oh, it has lignens and
14 all kinds of stuff. Well, leave that to the chemists.

15 MR. FISHER: Yeah.

16 MR. GUZONAS: I don't think there's
17 anything leachable in the walnut shell because it's
18 the external part. It's not part of the fruit itself.

19 CHAIRMAN WALLIS: It's more like wood,
20 isn't it? Cellulosic. Okay.

21 MR. FISHER: So our procedure for what we
22 call a thin bed test, which others would call a high
23 particulate test or low fiber test, is we mix up the
24 particulate and we add that to the test loop first and
25 have that circulating through the test loop, and at

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1 first it's all going through the holes in the strainer
2 and going through the loop, and then we prepare the
3 batches of fiber, and we prepare those in a one-
4 sixteenth inch theoretical bed thickness per batch,
5 and then we add the fiber in batches, and we wait
6 between additions for the pressure to stabilize with
7 that amount of fiber in it before we go on to the next
8 addition.

9 CHAIRMAN WALLIS: What you're assuming is
10 that there's enough particulate to fill the gaps in
11 the fiber because of sillital (phonetic) fiber?
12 That's what gives you your thin bed?

13 MR. FISHER: That's right. So what we
14 typically find is that one-sixteenth of an inch we
15 will capture some particulate, but we won't capture it
16 all. The water will stay cloudy. When we go to one-
17 eighth of an inch for Surry and North Anna, we find
18 that we are able to capture all of the particulate,
19 but it takes a long time to do it.

20 Here's some photographs of mixing and
21 adding particulate and then fiber. So in the upper
22 left we've already mixed up the walnut shell. That's
23 why the water is that brownish color, and here we're
24 adding CalSil. This would be a Surry test.

25 And then on the upper right we are now

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1 adding that particulate into the tank, and you can see
2 it's going in as a brown, soup-like mixture, and we
3 put it in by buckets over towards where we have the
4 stirrer. So it gets disbursed across the whole tank.

5 Then in the lower left we have our batch
6 of fiber after we've added it to water, mechanically
7 stirred it, and then used a pressure washer for at
8 least two minutes to break up the fibers. What we
9 have here is a combination of Thermal Wrap, Cerafiber,
10 and TempMat in that addition there, and then again we
11 add that as shown in the lower right in buckets under
12 the water surface and putting it over towards the
13 stirrer so that it gets mixed up and disbursed around
14 the tank.

15 The re-addition is slightly different if
16 we're looking at the full debris load case. Here we
17 use RMI, whereas we don't use RMI in the thin bed
18 test, and to start with once we have flow stabilized,
19 we drop the large pieces of RMI between the fins, and
20 then we mix the particulate, the fiber, and the small
21 pieces of RMI together in batches, either 25 percent
22 of the total or ten percent of the total, depending on
23 how much total fiber we have to add, and then we add
24 those batches to the tank.

25 And between additions and periodically

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1 after we have all additions in, we brush the bottom of
2 the tank to re-suspend any fiber and particulate
3 that's dropped on the suspension to encourage it to
4 transport to the test section.

5 I jump now to debris introduction to the
6 large scale test, and large scale is just a larger
7 operation as compared to the reduced scale. So rather
8 than mixing in a bucket, here we're mixing in a pool,
9 in ground pool that we use as our mixing tank, and you
10 can see that on the left.

11 And this is a fiber addition in this
12 particular test for a thin bed test, but rather than
13 using all fresh water, we pull water out of the test
14 tank to mix the fiber in, and that's why the water is
15 brown, because we already have the particulate in the
16 water, and then we've added the first debris addition
17 there.

18 And I think a word that someone used
19 yesterday to describe this is it's like oatmeal, the
20 mixture, and you can see that the greenish type of
21 fiber is floating more than the yellowish, and that's
22 the Fibrex which is more difficult to wet.

23 And then we pump this up into the tank
24 using a sludge pump, and that's what we're showing on
25 the right, it being pumped up into the tank.

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1 And we put it into the tank --

2 CHAIRMAN WALLIS: It's like oatmeal.
3 Oatmeal, this is oatmeal before it is cooked. Oatmeal
4 cooked is pretty goopy.

5 MR. FISHER: Yeah, this is before it's
6 cooked, when it's clumps of goop and --

7 CHAIRMAN WALLIS: Yeah, but cooked oatmeal
8 is really pretty stiff stuff. You don't get to that
9 constituency, surely.

10 MR. FISHER: No, we don't.

11 Now, as I said, we haven't started
12 chemical effects testing yet, but the purpose of that
13 would be as a bump-up factor to determine the increase
14 in debris bed head loss due to the chemical reactions
15 that form precipitates, and our intent is to do that
16 in the reduced scale facility with the water in that
17 facility having the appropriate pH and the appropriate
18 boron concentration.

19 CHAIRMAN WALLIS: Do you let the chemical
20 reaction occur in the loop itself?

21 MR. FISHER: Right now our plan is no.
22 I've argued against that. As a mechanical engineer,
23 I don't want chemistry taking place in my loop. It
24 seems to be too uncontrolled as to what's happening.

25 CHAIRMAN WALLIS: Well, that's the whole

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1 point. There's the whole question about how the
2 precipitate forms and does this make a difference to
3 its actual nature and how it fills up the pores or
4 whatever it's going to do.

5 MR. FISHER: Right, and so in reality it
6 would be nice to start with the loop very hot, put the
7 chemicals in and then lower the temperature of the
8 loop, the time, and precipitates form, but we're going
9 to be running a constant temperature. One hundred and
10 four Fahrenheit is what we normally use, and so what
11 we're proposing to do is to first start with a
12 benchtop program to show that we can on the benchtop
13 at least form precipitates that look or can be
14 characterized like the ones that the WCAP calls for.

15 And then if we can do that, then we want
16 to add chemicals done that way or precipitates done
17 that way to the test tank, and the idea would be to
18 first form a thin bed on the test section and then
19 produce the precipitate in a smaller tank and then add
20 the precipitate from the smaller tank into our test
21 tank and observe the increase in head loss.

22 So that's what we're negotiating right now
23 with our clients, is that approach.

24 CHAIRMAN WALLIS: Well, you're saying
25 observe increase in head loss. You're actually going

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1 to observe the head loss, whatever it does, right?

2 MR. FISHER: Right, right.

3 We have done some bypass testing. WE've
4 done these as a separate test. We've done tests to
5 look up fiber bypass, and we've done separate tests to
6 look at particulate bypass. When we're looking at
7 fiber bypass, we only added the fiber to the tank.
8 When we're doing the particulate bypass. We put the
9 latent fiber in with the particulate, and the major
10 way that we're measuring and coming up with results is
11 by taking grab samples from the pump line and then
12 filtering that and drawing the filter paper and then
13 weighing filter paper to determine the total bypass as
14 a total suspended solids.

15 And then in limited cases we are then
16 taking pieces of the filter paper and cutting them
17 down and putting them under an SEM/EDX and using that
18 to identify types and sizes of the debris and to
19 actually count fibers to determine the fiber bypass.

20 Here's a typical result from Millstone 2
21 testing.

22 CHAIRMAN WALLIS: What's the length of
23 that strangely coiled --

24 MR. FISHER: There's a bar at the bottom
25 which is one millimeter.

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1 CHAIRMAN WALLIS: Yeah, but what's the
2 length of that thing that's sort of a squashed figure
3 eight.

4 MR. FISHER: Yeah.

5 CHAIRMAN WALLIS: What's its length? Is
6 its length the --

7 MR. FISHER: In the order of one
8 millimeter.

9 CHAIRMAN WALLIS: Is its length when it's
10 stretched out? That's what you mean by length?

11 MR. FISHER: That's a good question.
12 We'll ask Dave here. He actually --

13 MR. GUZONAS: The length is the stretched
14 out length.

15 CHAIRMAN WALLIS: Stretched out length.
16 Okay.

17 MR. GUZONAS: So it's measured in
18 segments.

19 CHAIRMAN WALLIS: Okay.

20 MR. FISHER: On the right is a histogram
21 of fiber lengths, and the results are similar to what
22 other vendors we were talking about this morning,
23 which is that most of the fibers are a millimeter or
24 less in length, 80 thou. We do see a small number of
25 fibers as large as two millimeters in length, but the

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1 vast majority of them are less than half a millimeter.

2 In this particular test we added the fiber
3 in ten increments, and we measured the bypass before
4 we started adding fiber, and then between each
5 increment of ten percent we put more and more fiber
6 into the test loop, and then we measured the fiber --
7 sorry -- the bypass for an additional five turnovers
8 of the loop after all the fiber was in.

9 And this particular sample I show here is
10 half of the third turnover after all of the fiber was
11 in.

12 On this page here we show the fiber
13 concentration at each of the five turnovers after all
14 of the fiber was in, and you could see us going down
15 with time. These numbers here were calculated by the
16 SEM results, actually counting up the fibers and then
17 coming up with weight by calculating the volume of
18 fibers from the lengths and diameters and multiplying
19 by the particle weight of the fiber.

20 This is the result of a particular bypass
21 test. Here we ran for many more turnovers and the
22 results here are from time zero. At time zero we
23 added in the particulate, and then we added in the
24 latent fiber, and so time zero is how much particulate
25 was circulating through the system before the fiber,

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1 and the next data point is once the latent fiber is
2 added and we have data points and turnovers --

3 CHAIRMAN WALLIS: Taking a long time to
4 come out.

5 MR. FISHER: It took a long time to come
6 down, but it does come down with time.

7 The turnover for this test was 15 minutes.
8 So we went to 172 turnovers, which was 40 hours. It
9 came down significantly over time, but we can't say
10 how much of that is from debris capture on the latent
11 bed and how much is from settlement of the circulating
12 particulate.

13 Here's a typical test result for a thin
14 bed test. Focus on the pink line, please. That's the
15 head loss measured over time, the time scale on the
16 bottom. It's 48 hours, the whole test from one end to
17 the other, and I think it's seven divisions. So each
18 division is about seven hours.

19 CHAIRMAN WALLIS: But it's going up
20 because you keep on collecting more particulates. Is
21 that the idea?

22 MR. FISHER: Yeah, but we have several
23 behaviors here. At first we have a slight increase.
24 The fiber addition went in right here.

25 CHAIRMAN WALLIS: Whatever you do, don't

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1 write on the screen.

2 MR. FISHER: No, it's turned off.

3 Actually it might be a laser printer. There you go.

4 CHAIRMAN WALLIS: Okay. That's all right,
5 fine.

6 MR. FISHER: So the first five additions
7 right here, and for the first addition of one-
8 sixteenth of an inch we only wait an hour and a half.
9 So we see --

10 CHAIRMAN WALLIS: You keep adding fibers
11 now? Is that what's happening?

12 MR. FISHER: Yeah. Here, and an hour and
13 a half later we added a second sixteenth of an inch,
14 and we had a little S curve as that fiber accumulated
15 on the screen, and then once it accumulated on the
16 screen, then we have this linear behavior here as
17 we're slowing picking up the particulate, and that
18 went for over a day to slowly raise the head loss from
19 around .2, about .1 or .2 psi all the way up to over
20 1.4 psi.

21 Finally at this point here we get a curve
22 and then a stable region as we've soaked up all of the
23 particulate we can.

24 CHAIRMAN WALLIS: That leap up is because
25 you change the flow rate or something?

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1 MR. FISHER: Yeah, and then we have
2 another debris addition here.

3 CHAIRMAN WALLIS: Add some more stuff.

4 MR. FISHER: Add more stuff, and here,
5 this is the Surry test section, and here we get quite
6 an increase as we put that third one-sixteenth in. I
7 believe it's because the pins are so close together
8 that it's really more of a confinement effect than a
9 debris capture effect. At this point here the water
10 was very clear. You could see right to the bottom of
11 the tank, and here we don't have this linear portion.
12 It quickly stabilizes. So that's why I think it's a
13 different behavior.

14 And then we have that once more here as we
15 go to a quarter inch. At this point all of the fiber
16 that is present in the station is in. So that's the
17 total head loss. For Surry it's a combination of a
18 thin bed effect, and then a confinement effect.

19 And we ran a test a total of two days, 48
20 hours. So it takes a long time to capture all of the
21 particulate.

22 Our termination criteria is similar to
23 everybody else's. We go with a five percent change
24 within three tank turnovers, which in this case for
25 Surry a tank turnover was half an hour. So it's one

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1 and a half hours.

2 But what we tend to run up against more
3 often is the no general increase. So along the way
4 here we may have hit the five percent criteria, but we
5 still had a general increase in trend. So we would
6 allow it to keep going.

7 There's what the debris on the test
8 section looks like at the end of one of these tests,
9 and the majority of the debris has settled on the fins
10 or between the fins, just under 90 percent, and I see
11 that in the photo in the left, and then the photo in
12 the middle here, once we drained the water from the
13 test section, the debris bed has come off of the test
14 section, and it's composed of two different parts, the
15 dark, thin bed which had been pressed up against the
16 fin and then the additional fiber deposits from that
17 third and fourth addition which had just squeezed into
18 the gap between the fins.

19 On the right-hand side --

20 CHAIRMAN WALLIS: Did you do anything with
21 these sort of felted layers afterwards? Did you
22 examine them in some way?

23 MR. FISHER: At this point, no. We just
24 take this level of photographs of them. We have two
25 pieces lying on a cloth here on the right. The piece

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1 in the upper left-hand part of the photograph is lined
2 such that the part of the bed had been up against the
3 thin surface is upwards, and you see that's very dark
4 because there's a lot of particulate in it.

5 CHAIRMAN WALLIS: There's no impression of
6 the perforations on the --

7 MR. FISHER: Yes, there are.

8 CHAIRMAN WALLIS: I don't see it, but
9 there is in reality?

10 MR. FISHER: In reality there is.

11 CHAIRMAN WALLIS: Okay.

12 MR. FISHER: You can see where every hole
13 was.

14 CHAIRMAN WALLIS: I expect you would, but
15 you don't. It's not shown in the picture very well.

16 MR. FISHER: No. And then the other piece
17 of fiber which is in the lower right, again, it's
18 lined with the thin side up, but you can see on that
19 one the less dark area where it's the additional fiber
20 that we put in after we had already soaked up all of
21 the particulate.

22 MR. CARUSO: So does this mean that you
23 think you formed the thin bed of fact on top of an
24 existing --

25 CHAIRMAN WALLIS: Underneath.

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1 MR. CARUSO: On top or underneath?

2 MR. FISHER: Underneath.

3 MR. CARUSO: Underneath.

4 MR. FISHER: Underneath. These pieces are
5 turned over.

6 CHAIRMAN WALLIS: Now, they made a
7 sandwich, but the thin bed is against the filter,
8 isn't it? Isn't the thing bed against the strainer?

9 MR. FISHER: Yes, and then we have
10 additional fiber on top of that from the third and
11 fourth --

12 CHAIRMAN WALLIS: And you could probably
13 lay down another thin bed if you wanted to keep going.

14 MR. FISHER: There's debate upon whether
15 you can. It depends on how well the particulates
16 migrate.

17 CHAIRMAN WALLIS: Right. That's right.

18 MR. FISHER: To go through the fiber.

19 CHAIRMAN WALLIS: That's right.

20 MR. FISHER: The smaller the particulate,
21 the further they'll travel through the fiber.

22 CHAIRMAN WALLIS: Since they're so
23 difficult to separate out in one pass, that means that
24 they go through.

25 MR. FISHER: They go through multiple

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1 times, yeah.

2 CHAIRMAN WALLIS: That's right.

3 MR. FISHER: And what we find is that it
4 takes time to filter them all out because first you're
5 picking up the larger ones and they're making the bed
6 more dense and allowing the bed to collapse down and
7 become more of a dense bed, and then you start picking
8 up the finer ones.

9 CHAIRMAN WALLIS: It presumably means that
10 a slurry of particulate is going through the reactor.

11 MR. FISHER: That's right.

12 CHAIRMAN WALLIS: And we assume or we hope
13 that nothing happens to them as they go through
14 because of the heating or anything like that or what
15 is going on in there.

16 MR. CARUSO: But you didn't look at the
17 morphology of the pad, did you?

18 MR. FISHER: No. No, we haven't.

19 Here's a comparison of a thin bed test
20 result to the NUREG correlation. On the horizontal
21 axis we have the theoretical bed thickness, and on the
22 vertical axis on log scale is the head loss, and the
23 lower curve is called fiber only. There the only
24 particulate we have there is the suspended solid that
25 comes in in our service water when we pull onto the

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1 pipes, which at this time of year was about 0.8 ppm.
2 So that's what causes the head loss on that curve.

3 The upper curve is the head loss for the
4 reactor condition.

5 CHAIRMAN WALLIS: The head loss is bigger
6 than the NUREG or what are you saying?

7 MR. FISHER: In this case the head loss is
8 30 percent less than the NUREG. There are three test
9 points there and --

10 CHAIRMAN WALLIS: Because it's a log
11 scale.

12 MR. FISHER: It's a log scale, and NUREG
13 is about 1.3 PSI.

14 CHAIRMAN WALLIS: Okay. So that's the
15 NUREG with the particulates.

16 MR. FISHER: That's right, and that
17 straight portion there is where it's cut off by the
18 thin bed effect and then --

19 CHAIRMAN WALLIS: And then it falls down
20 again?

21 MR. FISHER: -- the sludge compression.
22 Sorry?

23 CHAIRMAN WALLIS: It actually comes down?

24 MR. FISHER: It comes down.

25 CHAIRMAN WALLIS: If you distribute the

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1 particles throughout the whole bed.

2 MR. FISHER: That's right.

3 CHAIRMAN WALLIS: Okay.

4 MR. FISHER: Yeah.

5 CHAIRMAN WALLIS: Once the thin bed is
6 there, it's there forever.

7 MR. FISHER: That's right.

8 CHAIRMAN WALLIS: So you continue flat.

9 MR. FISHER: Right. If you can design a
10 strainer that avoids that thin bed area, then you can
11 have a smaller strainer.

12 CHAIRMAN WALLIS: Or you can get more
13 fibers to arrive early or something.

14 MR. FISHER: Right, and with our testing
15 we haven't been able to prove that we can get away
16 from that.

17 CHAIRMAN WALLIS: I'm not quite sure how
18 you managed to get a NUREG thin bed effect because I
19 thought the NUREG couldn't predict thin bed very well.
20 Maybe that's only the Los Alamos test they couldn't
21 predict very well.

22 MR. FISHER: Well, the current formulation
23 of NUREG has a cutoff. It used to go asymptotically
24 up as you went with less and less --

25 CHAIRMAN WALLIS: You have to put in some

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1 number though for the area, for the unit volume of the
2 particulates.

3 MR. FISHER: You have to put in numbers
4 for the --

5 CHAIRMAN WALLIS: So you determine
6 experimentally or by doing a head loss tests. So it's
7 sort of circular, isn't it?

8 MR. FISHER: Well, what's required to get
9 that straight line across is the sludge density. How
10 tight will this thing pack? And what we're using in
11 this is numbers from the NEI-0407 guidance.

12 CHAIRMAN WALLIS: You also need a surface
13 area of unit volume for the particulate. I mean a
14 particulate size or something.

15 MR. FISHER: Yes, you do, yeah.

16 CHAIRMAN WALLIS: And you're putting in
17 the particulate size that you measured or are you
18 putting in the particulate size that correlates the
19 data?

20 MR. FISHER: We're using the average
21 particulate size of what we measured.

22 CHAIRMAN WALLIS: So that's pretty good
23 because usually folks actually claimed that it doesn't
24 work too well because the effective particulate size
25 is different.

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1 MR. FISHER: The particulate in this test
2 is all walnut shell flour, and we put it in as being
3 20 microns diameter with 23 where we measured it.

4 CHAIRMAN WALLIS: Well, maybe it behaves
5 better than CalSil in some ways.

6 MR. FISHER: Sorry?

7 CHAIRMAN WALLIS: Maybe it's better than
8 CalSil perhaps.

9 MR. FISHER: Yes.

10 CHAIRMAN WALLIS: In terms of correlating.

11 MR. FISHER: Yes. When you have CalSil
12 in, we're not near as close. In fact, we're over
13 predicting. We're over measuring in some cases.
14 We're measuring above what we're predicting, and
15 perhaps we're using too large a particle size in our
16 predictions.

17 MR. CARUSO: You have particle sizes for
18 the walnut shells dry, right?

19 MR. FISHER: Yeah.

20 MR. CARUSO: And they don't absorb any
21 water and swell?

22 MR. FISHER: We've done swelling tests on
23 them. It's less than five percent increase.

24 MR. CARUSO: So you've actually measured
25 sizes before and after, size distributions dry and

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1 size distributions wet?

2 MR. FISHER: No, our swelling tests
3 weren't quite done that way.

4 Dave?

5 MR. GUZONAS: What we did, because it was
6 easier and also we thought that doing an SEM
7 measurement of the particle size after wetting it
8 would actually dry it out --

9 MR. CARUSO: Right.

10 MR. GUZONAS: -- was measure the volume in
11 a narrow tube of the wetted and dry materials. So it
12 was a sedimentation volume measurement more than
13 anything.

14 We would leave it sit for 24 hours, 48
15 hours, 72 hours and simply measure the volume of the
16 walnut shells, a fixed mass of walnut shells as a
17 function of time, and there was no noticeable change
18 in volume.

19 It was a well packed, initially dry mass
20 of walnut shells. We then wetted it, let it sit as a
21 function of time, and then we heated it to see whether
22 heating the walnut shells for a certain period of time
23 would increase the volume as well, and there was no
24 change.. That was the only way that we believed we
25 could do the measurement without introducing an

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1 artifact from drying the particles again.

2 MR. FISHER: There are three points on
3 this curve here. It's from one test, but it's the
4 three one-sixteenth inch additions, and here we found
5 it took three-sixteenth of an inch for Millstone to
6 form a debris bed.

7 We actually went to a fourth and fifth
8 addition after that, and the head loss is increasing
9 only due to the additional fiber, and you don't see an
10 increase on a log scale.

11 CHAIRMAN WALLIS: But on a log scale the
12 pressure drops when you put the particulates int.
13 It's 100 times bigger than it is the fibers alone.

14 MR. FISHER: Yeah, and it's a very sharp
15 drop from the thin bed regime to the mixed bed regime.

16 CHAIRMAN WALLIS: And it's a big
17 difference, a big factor. Talking about a factor of
18 30 to one or something.

19 MR. FISHER: Yeah, over an order of
20 magnitude change.

21 CHAIRMAN WALLIS: But it's really striking
22 if you look at the fiber. You've got a factor of
23 1,000 from fibers alone to fibers per thin bed when
24 you're down at a quarter of an inch or something.

25 MR. FISHER: Here are some pictures at the

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1 end of a full degree load for Millstone 2, where we
2 allow it to what we call encapsulate, and on the left-
3 hand side we still have water in the tank there, and
4 you can see how clear it becomes even in this case.
5 We do filter all of the particulate out, but it's not
6 a high head loss because the particulate is
7 distributed over a much larger volume of fiber, and
8 you see it packs in between the fins.

9 Now, the design here you can see in the
10 center quarter graph. We have a support structure
11 between the fins we call ladders to hold the fins
12 apart during a seismic event, and those form a barrier
13 under the full debris load even though there's wide
14 spaces in them. The fiber bridges those spaces.

15 So we get heavy packing of the fiber in
16 front of those ladders, but we don't get heavy packing
17 back behind them. We have cavities, but then we get
18 a bridging effect across the whole top of the strainer
19 where we're bridging across ten inch gaps, and we end
20 up with this big, thick layer on top.

21 When we're doing a full debris load test,
22 we remove the baffle that's at the front of the
23 strainer to allow the fiber to tumble out the front
24 end as it would in reality. So we do get some debris
25 in front of the fins as shown on the right-hand side.

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1 Here's a head loss curve for the full
2 debris load case, and here, again, is time scale and
3 the pink line is head loss, and you see more of the
4 traditional S curve here where things stabilize much
5 more quickly than in the procedure we're using for
6 thin bed.

7 The test here ran for -- started at 9:00
8 a.m. and ended at 5:00 p.m. So about nine hours, and
9 we waited until we had a stable head loss over an hour
10 and a half at the end there to terminate the test.

11 So overall the head loss here is much less
12 than in the thin bed case.

13 CHAIRMAN WALLIS: It's a log scale though.
14 So that's --

15 MR. FISHER: No, the head loss is a linear
16 scale.

17 CHAIRMAN WALLIS: Oh, okay.

18 MR. FISHER: Sorry. Used a log scale on
19 the left-hand side to show the other parameters.

20 And here's some pictures of the thin bed
21 test done in the large scale rig for Millstone 2, and
22 we formed a bed very similar to what we saw in the
23 reduced scale break away, a brownish thin bed attached
24 all over our strainer, and then lumps of fiber on top
25 of that from the later fiber additions once we stopped

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1 picking up any particulate.

2 You can see that some of the bed has
3 fallen off on the left-hand photograph. On the left-
4 hand photograph we drained the water down about a
5 foot. The black you see between the fins there is the
6 top of the water layer, and you can see that the thin
7 bed has peeled off the very top of the fin.

8 And it's almost like a chalk substance,
9 the thin bed for Millstone 2. There's so much
10 particulate in it that it's very hard to see the
11 fibers. And you can see that some of the fibers have
12 collected on the ladders.

13 Now, this is the other case for Millstone
14 2 where we put all of the fiber in. Now, the top
15 photograph here, end of test cover all, and you can
16 see the water is pretty clear, but you can't see the
17 strainer because there's a stainless steel plate over
18 top.

19 The client has asked for us to provide a
20 cover over the strainer so that they can use it as a
21 lay-down area during outages, but not drop things down
22 in there that they have to then retrieve.

23 So we are testing under this load
24 condition with this cover in place because it will add
25 some confinement for this case, and we have to show

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1 that our pressure loss stayed low enough.

2 So then along the bottom I have three
3 photographs of the strainer once the covers are moved.
4 The center one is looking at the center pins, and
5 there we can see there are two cavities behind the
6 ladders, and then the right and left photographs show
7 the outer fins on each end, and there the fiber had
8 piled up, all the way up to be touching the underneath
9 of the cover in two locations.

10 The cover was nine inches above the top of
11 the fins.

12 So a summary of our key observations. We
13 are finding that our surface area is being determined
14 by thin bed, but the amount of real estate we take up
15 in the reactor, what we call footprint, is determined
16 by how far apart we have to put the fins to handle a
17 full degree load.

18 We're finding that the measured head loss
19 is comparable to the NUREG predictions, and as I
20 mentioned before, we find that it takes more fiber
21 additions to form a thin bed when you're at lower
22 approach velocities.

23 And the fiber bypass, we find that what's
24 bypassing is short fibers.

25 CHAIRMAN WALLIS: Let me ask you about

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1 this thin bed. In this thin bed, when Los Alamos did
2 tests with thin beds with CalSil, they got some
3 somewhat anomalous results where the pressure drops
4 versus flow rate would go along on some curve, and
5 then it would suddenly leap up by a factor of maybe
6 size ten at some flow rate where something has changed
7 in the structure of the bed, and you couldn't say that
8 it was a thin bed. It was something that was actually
9 not just a thin bed effect. Something fundamentally
10 seemed to be changing in the structure of the bed
11 itself.

12 You haven't observed anything like that?

13 MR. FISHER: No, but we haven't done that
14 sort of test where we're changing the flow rate.

15 CHAIRMAN WALLIS: Because their flow rate
16 is much bigger than yours. Maybe the velocity through
17 the bed was higher or something.

18 MR. FISHER: We're running at a constant
19 flow rate and --

20 CHAIRMAN WALLIS: Yeah, but even so --

21 MR. FISHER: And the one odd thing that we
22 have seen is our thin bed tests where we have calcium
23 silicate in there, we've seen that the head loss has
24 increased to a point and then started to fall off
25 slowly, and we're attributing that to perhaps the

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1 CalSil is continuing to break down into smaller
2 pieces, and then going right through the strainer, but
3 we don't have the evidence to support that.

4 But I would certainly think with CalSil
5 it's a more complicated bed than without.

6 CHAIRMAN WALLIS: And then when they
7 tried to correlate it, what they did was they changed
8 the specific area of the CalSil, passed the test in
9 order to correlate the data, which means that they
10 didn't have a very good predictive tool perhaps.

11 MR. FISHER: Right, yeah. When we're
12 using --

13 CHAIRMAN WALLIS: We haven't heard
14 anything from any of these experiments in the last
15 couple of days, which seem to show this sort of
16 anomalous result.

17 MR. FISHER: When we're using CalSil in
18 our predictions we say it's a five micron size, the
19 average size from NEI-0407, and we're finding for both
20 surry and North Anna that our measured head loss is
21 going above the prediction in those cases.

22 And that could be a reason, that the
23 actual outlet is small.

24 CHAIRMAN WALLIS: What is your superficial
25 velocity through the bed typically? It's very low I

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1 think, compared with anything they did.

2 MR. FISHER: It's low compared to
3 anything. The upper range of what we're testing when
4 we're testing a real strain of the sizes we're doing
5 is smaller than their smallest number when they're
6 deriving the correlation.

7 So to finish off here, obviously if we
8 have no fiber bed, all of the particulate is
9 bypassing, but we did find that the latent fiber was
10 sufficient in the test we did there to capture some of
11 the debris. So we can't differentiate between capture
12 and settlement.

13 And that's everything.

14 CHAIRMAN WALLIS: Very good. Thank you
15 very much. So we don't need to see you this
16 afternoon?

17 MR. FISHER: Unless you come up with
18 additional questions, which I hope not.

19 CHAIRMAN WALLIS: Well, that is a good
20 sign and a bad sign if there are no questions.

21 MR. FISHER: I'll take it as the --

22 CHAIRMAN WALLIS: The good sign might be
23 that you did a great job. A bad sign might be that no
24 one was interested.

25 MR. FISHER: Yeah, that's right. I think

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1 being the last one, all of the questions have been
2 answered.

3 MEMBER MAYNARD: From my perspective it
4 would be a good sign because I thought it was a good
5 presentation.

6 MR. FISHER: Thank you.

7 CHAIRMAN WALLIS: Yes, I thought it was a
8 good presentation, too.

9 Are there any other observations from the
10 committee? Are you ready to take a break?

11 I think we ought to take a break until
12 about one o'clock. Would that be appropriate?

13 MEMBER KRESS: Let's do that.

14 CHAIRMAN WALLIS: Or do we have to have --
15 are we allowed to start with Tim Andreychek at one
16 o'clock?

17 MR. CARUSO: I think so.

18 CHAIRMAN WALLIS: You think so or you
19 actually confirmed that that is --

20 MR. CARUSO: We didn't actually publish
21 the agenda in the Federal Register.

22 CHAIRMAN WALLIS: Okay. So we'll look
23 forward to Andreychek at one o'clock.

24 MEMBER KRESS: Maybe we should never
25 publish the agendas.

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1 CHAIRMAN WALLIS: Okay. So we're ready.
2 We're thanking everybody who presented this morning,
3 and we're taking a break until one o'clock.

4 (Whereupon, at 11:47 a.m., the meeting was
5 recessed for lunch, to reconvene at 1:00 p.m., the
6 same day.)

AFTERNOON SESSION

(1:00 p.m.)

1
2
3 CHAIRMAN WALLIS: Tim Andreychek, telling
4 us what's going on, where we are today.

5 MR. DINGLER: Somebody gets men who are
6 actions, and as John says, we're not going to win the
7 data war, but what we want to do is give you an
8 overview of where we're looking at fuels.

9 What we have done so far in the field area
10 with our data research and testing and that is to give
11 you an idea where we're going and what we're seeing
12 today. We're just getting started on some of this, a
13 nd so keep that in mind as you go forward. We're on
14 the initial stages and a lot of work yet to be done,
15 but we think as you heard the last couple of days from
16 the NRC and previously, we believe we have a path
17 forward that we can minimize this approach for the
18 majority of the plant for stuff like that.

19 So I want to turn it over to the Tim to
20 give you the details.

21 MR. ANDREYCHEK: Thank you.

22 Good afternoon, and thank you for the
23 opportunity to address this subcommittee meeting.

24 With regards to fuel valuations and
25 downstream effects, the method presented in WCAP

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1 16406-P, which was submitted to NRC for a safety
2 evaluation, was used to evaluate collection of fibrous
3 debris on components. The method assumed a very large
4 capture efficiency of fibrous debris on the first fuel
5 components in the flow path, and by large, I'm talking
6 about a 95 or so percent capture frequency.
7 Sometimes --

8 CHAIRMAN WALLIS: First fuel component, do
9 you mean the debris catching plate?

10 MR. ANDREYCHEK: The bottom nozzle? Yes,
11 the bottom nozzle which had in it the debris capturing
12 device, and it's approximately accurate for all three
13 fuel designs, whether it be the former Combustion
14 Engineering, the AREVA design, or the Westinghouse
15 design. The fuel capturing device is right down
16 there.

17 CHAIRMAN WALLIS: Now, we hear this
18 morning or yesterday and this morning that what gets
19 through these strainers is often the very short
20 fibers, less than a millimeter maybe, and I doubt if
21 they would be captured. I mean, you say fibrous
22 debris. You mean the longer fibers, don't you?

23 MR. ANDREYCHEK: Well, you are correct,
24 and when we wrote the WCAP and we wrote the methods
25 described in the WCAP, we did not have bypass data

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1 from sump screens at that point in time. So what I'm
2 talking about is where we are today with the methods
3 that were defined in that particular WCAP, and I'm
4 going to lead you to where what we're looking at
5 moving ahead and moving forward. Okay?

6 And, again, the second sub-bullet we
7 assumed that the fibrous debris mattered like those
8 forms on flat screens with the large fibers.

9 The NUREG 6224 head loss correlations used
10 to conservatively address head drop across this fiber
11 bed, and based on this approach, relatively small
12 amounts of fibrous debris would result in the
13 prediction of thin bed effect pressure drops, very
14 large pressure drops with a very small amount of
15 fiber.

16 And this particular method was used to
17 evaluate all PWRs for fuel blockage for the submittals
18 that were given to NRC to Generic Letter 2004-02.

19 MR. DINGLER: And if we were good in the
20 screening and everybody passed, we shouldn't be back
21 up here talking to you.

22 MR. ANDREYCHEK: That's correct.

23 There has been some initial testing with
24 the specific debris mix in fuel assembly geometry that
25 showed that the fibrous debris did not mat. I think

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1 you saw that yesterday. And, therefore, the NUREG CR-
2 6224 correlation over predicts pressure drop for
3 fibrous collection on the bottom of the fuel. It's
4 our conclusion that additional valuations are needed
5 to refine the analysis while demonstrating significant
6 margin to overheating the core and also to address
7 certain phenomena in more detail.

8 CHAIRMAN WALLIS: To go back to this
9 statement, "Fibrous debris does not mat," do you mean
10 that it does not collect?

11 MR. ANDREYCHEK: It does not compress in
12 a tightly formed mat.

13 CHAIRMAN WALLIS: So it does collect.

14 MR. ANDREYCHEK: Yes, yes.

15 CHAIRMAN WALLIS: And presumably it
16 captures particulates within it.

17 MR. ANDREYCHEK: If the particulates are
18 moved up in their --

19 CHAIRMAN WALLIS: But it's the
20 particulates which are most likely to bypass.

21 MR. ANDREYCHEK: That's correct, and I
22 believe the data that you saw yesterday included
23 particulates with that fiber matting, and as a
24 consequence, again, the hydraulic forces associated
25 with the flow going up into the core -- remember that

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1 fuel assembly -- did not have enough hydraulic energy
2 to compress that combined particulate --

3 CHAIRMAN WALLIS: Really because the flow
4 rate is so low.

5 MR. ANDREYCHEK: That's correct, sir.

6 MEMBER BONACA: But some of the data shown
7 by Alcion yesterday showed if you had chemical, some
8 chemical effects may cause the --

9 MR. DINGLER: That's one area we should
10 have looked at, Tim.

11 MR. ANDREYCHEK: And, in fact, it's a
12 valid point and addresses the phenomenon in more
13 detailed. One of them is chemical effects. That's
14 what we're looking to do moving forward.

15 We're looking at blockage at the fuel
16 inlet, local blockages or hot spots, and we know that
17 crud does collect on fuel assemblies at certain
18 locations and chemical effects and what it would --

19 CHAIRMAN WALLIS: Probably any sort of
20 very fine chemical precipitate is the kind of thing
21 which would get through the strainers, too, and get
22 through perhaps the areas which don't have fibers on
23 them.

24 MR. ANDREYCHEK: Correct.

25 CHAIRMAN WALLIS: Which is very, very

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1 fine.

2 MR. ANDREYCHEK: Yes, yes. Looking ahead,
3 using as our guidance, we're going to take a look at
4 10 CFR 5046 for long-term cooling, and these quotes
5 come straight out of 5046.

6 The calculates core temperature shall be
7 maintained in an acceptably low value and decay heat
8 shall be removed for the extended period of time
9 required by the long-lived radioactive --

10 CHAIRMAN WALLIS: Are you talking about
11 the extended period of time? We heard this morning
12 about one year. How long is this extended period of
13 time?

14 MR. ANDREYCHEK: We looking at the 30-day
15 period of time that we've been using --

16 CHAIRMAN WALLIS: -- just to keep the core
17 cool.

18 MR. ANDREYCHEK: I beg your pardon?

19 CHAIRMAN WALLIS: You'd have to keep the
20 core cool as long as it's there.

21 MR. ANDREYCHEK: Correct.

22 CHAIRMAN WALLIS: Until you remove it or
23 do something else.

24 MR. ANDREYCHEK: That's correct.

25 CHAIRMAN WALLIS: So this could be a much

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1 longer time than a month.

2 MR. DINGLER: Keep that question. We've
3 got a slide in there which shows that after about 40
4 hours our flow is very varied and it keeps going down
5 because decay heat goes down. So keep that in mind.
6 We understand. So we're trying to get the area where
7 it's most crucial to us, and then decay heat takes
8 away or the amount of water goes down considerably.

9 CHAIRMAN WALLIS: Sure.

10 MR. ANDREYCHEK: And our success criteria
11 is demonstrating sufficient long-term core cooling
12 that we insure sufficient flow to remove decay heat
13 relative to Mo's comment just a moment ago in
14 maintaining a coolable core geometry.

15 There is a PWR project. The objective to
16 do this, the project objective is to develop methods
17 and evaluations to show the acceptance criteria for
18 long term core cooling are met. We're going to look
19 at blockage of normal core flow paths and assess the
20 need for flow, how much flow is needed to remove decay
21 heat.

22 We'll look at localized build-up of debris
23 and hot spots at grid spacers due to -- and due to
24 plate-out of chemical effects. The chemical effects
25 we're going to also be looking at are precipitates and

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1 plate-out on fuel.

2 Any questions?

3 CHAIRMAN WALLIS: Now, plate-out is an
4 interesting question.

5 MR. ANDREYCHEK: Okay.

6 CHAIRMAN WALLIS: How are you going to do
7 that? Heat up some zirc and flow stuff by it and see
8 what happens or what?

9 MR. ANDREYCHEK: First we have a
10 tremendous amount of information about what the
11 chemistry is of certain things inside the reactor as
12 it stands right now. We're going to use that as a
13 basis to build on. Whether or not we need tests is
14 yet to be defined, but we're going to take a look at
15 what we know about the chemicals that are currently in
16 the reactor mix.

17 CHAIRMAN WALLIS: So starting from the
18 beginning really with this plate-out question?

19 MR. ANDREYCHEK: We're going to look at
20 where we -- what we know right now today and then
21 build from there as necessary to address the
22 questions.

23 We've identified several tasks under this
24 project. The tasks have been scheduled such that they
25 address areas of uncertainty and vulnerability,

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1 confirm long-term core cooling capability and take
2 advantages of lessons learned from previous work.

3 The way we've scheduled the work is to
4 look at the blockage of normal core flow paths, the
5 localized build-up, and then coincident with that
6 chemical effects on long-term cooling capabilities.

7 With regards to blockage of normal core
8 flow paths, we want to demonstrate long-term core
9 cooling with significant blockage at the core inlet.
10 When you demonstrate that there's sufficient flow to
11 remove decay heat, that this is due in part to cross-
12 flow within the core that will allow redistribution of
13 the flow to remove decay heat such that the peak clad
14 temperatures are local and moderate.

15 CHAIRMAN WALLIS: Is there boiling
16 occurring in this core?

17 MR. ANDREYCHEK: It depends on the
18 transient that you're looking at. If it's a cold leg
19 break and it occurred -- the block of the core occurs
20 early, there might be boiling at the upper elevations
21 of the core.

22 If you're dealing with a hot leg break,
23 then all of the ECCS flow runs through the core. then
24 you might have a little bit of subcooled boiling early
25 in the transient if it occurs early. I have two

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1 photographs and I'll address that in just a few
2 moments.

3 We'll look at effects of degradation of
4 cladding oxide layer, hydrogen embrittlement of the
5 cladding, and accumulated diffusion of oxygen within
6 the cladding micro structure. I don't think that
7 that's going to be a significant issue given that the
8 core has already been quenched, but we'll take a look
9 at it.

10 We'll neglect alternate flow paths into
11 the core if such is flow through the baffle barrel
12 region in feeding the core, and the goal here is to
13 cover all Westinghouse and AREVA fuel pipes.

14 this is the diagram that Mo mentioned a
15 few moments ago. This shows minimum SI flow
16 requirements for a four-loop PWR. You can see from
17 the trend that the amount of flow that's necessary
18 decreases rapidly following the initiation event. At
19 ten hours it's only 200 gpm that's required to remove
20 decay heat. At 30 hours it's about 150 gallons per
21 minute.

22 CHAIRMAN WALLIS: Is this gallons at
23 normal temperature? I mean, the gallons are room
24 temperature?

25 MR. ANDREYCHEK: That's correct.

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1 MR. CARUSO: Is that assuming that that
2 flow rate is boiled or just --

3 MR. ANDREYCHEK: This system may boil off.

4 MR. CARUSO: That's a boil-off.

5 MR. DINGLER: This is the career boil-off.
6 These figures are actually out of the plan COPs. So
7 when we did the bulletin for containment for --

8 CHAIRMAN WALLIS: This is all based on
9 boiling it all away or what?

10 MR. DINGLER: This is to remove decay heat
11 so you don't have boiling in your coolant.

12 CHAIRMAN WALLIS: So you don't have any
13 boiling, and the decay heat goes to the whatever, some
14 of the exchange.

15 MR. DINGLER: RHR heat exchanger, yeah.
16 It can go from there.

17 MR. CARUSO: Wait a minute. So 150
18 gallons per minute is enough to remove decay heat
19 without boiling the water.

20 MR. DINGLER: That's correct.

21 MR. CARUSO: To take it from whatever the
22 injection temperature is to saturation temperature,
23 liquid.

24 MR. DINGLER: Because once the core is
25 quenched, you provide this much flow and push that

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1 much out the outlet and go through the RHR and keep
2 the core from boiling.

3 CHAIRMAN WALLIS: So it's just the delta
4 T going through the core. It heats up from what, 100
5 degrees to 200 or something?

6 MR. DINGLER: Whatever, yeah.

7 MEMBER BONACA: At this time there's a
8 circulation of flow, right?

9 MR. ANDREYCHEK: yes.

10 MEMBER BONACA: You're picking up and so
11 the temperature, what's the temperature of the water?

12 MR. DINGLER: The temperature of the water
13 would be, if you're actually feeding the water, would
14 be the temperature of the containment sump at that
15 point in time.

16 MEMBER MAYNARD: Typically you're varying
17 your heat exchanger temperature to control your
18 reactor temperature. So if the reactor is heating up,
19 then you crank in more cooling. So you're not
20 necessarily -- you're controlling the temperature of
21 the water going in, but not really determining how
22 much heat exchange is going on in the heat exchanger
23 is what is your core temperature is.

24 MR. ANDREYCHEK: Any other questions?

25 For the cold leg break scenario, I share

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1 this schematic. We're looking at some blockage down
2 at the bottom. The flow path is from the ECCS flow
3 down, up through. Again, as I pointed out and we
4 discussed a few moments ago, there would be some
5 localized boiling at the very top of the core after
6 quenching, and the steam-water mixture would be going
7 out the hot leg. You might get some condensation
8 falling back the hot leg. The water might not make it
9 all the way over the top of the steam generator.

10 And excess flow provided by the ECCS would
11 be out the break. Again, when I look at this
12 situation, we have limited ability to lift debris up
13 into the -- either fibrous or particulate up into the
14 core. The reason for that is that the velocities that
15 you see in the lower plenum are matching boil-off.

16 MR. CARUSO: I'm confused now. This is
17 boil-off or are you talking about -- I'm going back
18 to that GPN Monday. Is that a boil-off number or is
19 that a blow number?

20 I mean you remove a lot more heat when you
21 boil something. Where's the heating going out? Is
22 the heat going out as steam or is the heat going out
23 as a liquid?

24 MR. ANDREYCHEK: The 200 gpm number, if I
25 understand it correctly, comes from the EOPs, what you

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1 need to remove decay heat. Now, if that's the hot leg
2 break and you're moving decay heat, that's all you
3 need is 200 gpm. If you're looking at a cold leg
4 break, you need less flow, and you're going to be
5 given that flow not by a pump, but by the difference
6 in gravity head between what's in the core and what's
7 in the downcomer.

8 And at that point you're not really going
9 to be able to drive flow into the core unless you're
10 going through injection in the hot leg.

11 So that number that Mo gave you is what
12 you need to remove decay heat for a hot leg break.

13 MR. CARUSO: All right. I'm going to have
14 to go do some calculations. I don't know the decay
15 heat number at ten hours. That's the thing.

16 You think it's a boil-off. I think it's
17 a boil-off number.

18 CHAIRMAN WALLIS: Though we were told it's
19 a heat exchange number. It just heats the water up.

20 MR. CARUSO: Well, there's a big
21 difference because if you have boiling occurring
22 instead of --

23 CHAIRMAN WALLIS: A factor of ten
24 difference or something.

25 MR. CARUSO: Oh, yeah. Okay. We'll find

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1 out.

2 MR. HAFERA: Well, you have to recognize
3 that as Mr. Maynard was saying, the decay heat removal
4 heat exchanger is well over sized for the decay heat
5 load at that time, and that's going to be controlled
6 by the operator. So it really comes down to it's not
7 quite important whether it's single phase flow or
8 boil-off. An operator is going to adjust his system
9 as needed if it's a hot leg break to remove the decay
10 heat.

11 And the cold leg break, as Tim mentioned,
12 is going to be self-regulated by the flow out of the
13 break and the boil-off.

14 MR. CARUSO: Well, it does matter because
15 if you have a liquid flow out of the core, then you're
16 flushing debris out the break, but if you are boiling
17 in the core and just removing steam, you're leaving
18 all of that debris behind and you're concentrating it
19 in the core.

20 So the phenomena are very different and
21 the effect on the core coolability is very different.

22 MR. ANDREYCHEK: I don't disagree with you
23 that in one case you'd be building up particulates or
24 debris in the core, and you also will address that
25 through hot leg injection or recirculation at the

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1 appropriate time and flush that out of the core at
2 that point in time.

3 And depending upon the plant, there's some
4 variability in that time period.

5 Okay. For the hot leg breaks --

6 CHAIRMAN WALLIS: It looks like a boil-off
7 to me.

8 MR. CARUSO: I just don't know what the
9 decay heat number is.

10 CHAIRMAN WALLIS: It looks like 30
11 megawatts. We'll look at that.

12 MR. CARUSO: We'll look at it.

13 MR. ANDREYCHEK: Okay. Thank you.

14 For the hot leg scenario again, we're
15 looking at the earliest time for blockage formation
16 would occur at approximately 20 minutes after the
17 large break LOCA when you switch over from
18 recirculation or injection from the refueling water
19 storage tank or the borated water storage tank to
20 recirculation from the sump.

21 The flow rate into the core is determined
22 by the ECCS pump capacity. Again, not looking at
23 alternate flow paths, we have a little larger
24 capability of -- a little more capability of moving
25 fibers and particulate debris up in towards the fuel.

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1 However, again, based on the information
2 that was shared with you yesterday, there's still
3 marginal ability to compact the fiber that's collected
4 there, and I think what I would like to share with you
5 is we do get a recirculation pattern behind this
6 blockage, and I'll show you an example of that in a
7 moment.

8 We have conducted some core blockage
9 studies. The objective was to demonstrate that
10 redistribution across flow, across fuel grids will be
11 established behind blockage. The conditions were we
12 looked at a 3,411 megawatt thermal reactor core. We
13 studied four different blockages. Twenty percent of
14 the fuel block -- this is right below the active
15 length of the fuel -- deterministically didn't care
16 what the blockage mechanism was. It just occurred.
17 Forty percent, 60 percent, and 80 percent, and those
18 are denoted by the different colored rings, 20 percent
19 in the middle. The yellow is the 40 percent. Sixty
20 percent is green, and the 80 percent is the blue.

21 We started and we assumed that the hot rod
22 and the hot assembly was in the dead center of the
23 core. So that gave us a maximum decay heat location to
24 address.

25 And based on the current study sufficient

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1 flow was provided with 80 percent blockage to remove
2 the decay heat.

3 Next slide, please.

4 We used to find an element code to do this
5 calculation. This is the core center line right here.
6 The blockage was at the first elevation here, and what
7 you see is the flow redistribution flow path running
8 up through to the top of the core, being up here, and
9 this stream line is the recirculation pattern that
10 occurs directly behind the blockage that was assumed
11 and shows you the lines of constant velocity.

12 Next slide.

13 The net results were that the majority of
14 the core was minimally affected by the 80 percent
15 blockage. Some boiling would occur above the
16 blockage, but as the steam rises cooler fluid from the
17 periphery would be drawn in laterally. Behavior was
18 observed to be limited to the lower portion of the
19 core.

20 We did a bounding calculation of super
21 heat at the fuel rod surface and found that the upper
22 bound was about 400 degrees Fahrenheit, which in turn
23 was correlated to a clad surface temperature of about
24 600 degrees Fahrenheit. It's well below the 2,200
25 degree Dewey-Fahrenheit PCP limit.

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1 MR. CARUSO: Are you familiar with
2 historical staff practice with regard to the
3 acceptability of allowing core heat-up during the
4 long-term cooling phase of a LOCA?

5 MR. ANDREYCHEK: There's a letter that we
6 just got from the staff that indicated that the long-
7 term reheating capability or concerns would be
8 addressed if we demonstrated that there was minimal
9 bulk increase in temperature through the core.

10 MR. CARUSO: Is that consistent with the
11 historical staff practice on this issue?

12 MR. ANDREYCHEK: I can't answer that.

13 MR. SCOTT: Let me add something. Mike
14 Scott, NRC staff.

15 What's being referred to is a letter that
16 was it Westinghouse or the owner's group submitted to
17 us?

18 MR. ANDREYCHEK: Westinghouse.

19 MR. SCOTT: Westinghouse submitted to the
20 staff asking for our interpretation of what those
21 requirements you're referring to are, Ralph, and we
22 responded noting the fact that the staff's practice in
23 the past has been that there would not be any long
24 term heat-up, and we indicated that we would be open
25 to consideration of proposals that Westinghouse might

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1 come up with that satisfied certain specific criteria
2 regarding the longevity of the core. It was more or
3 less to kind of put the ball back in their court to
4 demonstrate to us that the fuel would not be damaged
5 if we allowed additional heat-up, some small amount.

6 MR. CARUSO: So the staff is in the
7 position now that it's changing its historical policy
8 regarding this criteria.

9 MR. SCOTT: That's not what I said. What
10 I said is the staff is willing for Westinghouse to
11 advance the proposal if they can justify it.

12 MR. ANDREYCHEK: There have been some
13 additional core blockage studies that have been
14 performed. One was using the RELAP 5 code. It used
15 a Westinghouse four-loop reactor core, reactor vessel
16 flow areas, and loss coefficient data. The double
17 ended guillotine break was assumed and analyzed in
18 limiting the full condition for water being supplied
19 to the core. The results were that no core reheat for
20 blockages up to, and this is a little understated
21 here. The actual total blockage considered was 99.7
22 percent at the beginning.

23 CHAIRMAN WALLIS: The .53 feet squared is
24 the flow rate that's left?

25 MR. ANDREYCHEK: That's correct, sir.

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1 CHAIRMAN WALLIS: The area that's still
2 available.

3 MR. ANDREYCHEK: That's correct. That's
4 correct.

5 The second evaluation that was done was
6 using the TRACE code. It used the core inlet strainer
7 in place from industry. Again, it was, I believe,
8 Westinghouse input that was used for that particular
9 calculation.

10 The core was divided into eight radial
11 segments with four rings and 14 elevations. No bypass
12 flow was assumed, and again, a double ended guillotine
13 break on the cold leg was assumed with recirculation
14 starting at approximately 1,200 seconds, and the
15 initial results that were obtained were comparable to
16 those of the RELAP 5 code.

17 The reason that I presented these was this
18 information tends to support that we can get adequate
19 core cooling with very small flow areas once we get
20 out into the transient.

21 Looking at the localized build-up of
22 debris and hot spots, again, to demonstrate long term
23 core cooling with localized debris at fuel grids is
24 acceptable. We want to assess the localized build-up
25 of debris at spacer grids. How do we collect it?

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1 We've heard over the last day and a half
2 a considerable amount of information about debris
3 passing through the screen of both fibrous and
4 particulate. Look at actual conduction through the
5 fuel rod as well as flow rates through the fuel.
6 Demonstrate sufficient heat is removed to address
7 local blockage concerns.

8 And the effects of degradation of clad
9 oxide layer, hydrogen embrittlement of the cladding,
10 and accumulated diffusion of oxygen within the
11 cladding micro structure will be considered under
12 these conditions.

13 There has been some additional work that
14 was done in support of the VWR resolution of
15 containment sump performance issue that was published
16 in the NEA/CNSI/R(95)11, otherwise known as the Green
17 Book. The adherence of fibrous debris to fuel rods
18 was addressed in a particular section. They used a
19 knife blade, steel heater rod or steel heated rods
20 heated to 2,200 degrees Fahrenheit, quenched in a
21 slurry of glass wool and associated insulation blanket
22 materials.

23 What was observed was there was very
24 little adherence of fibrous material to the knife
25 blade or to the steel rod. If something did adhere,

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1 it was due to the binder material that came with that
2 insulation, and the binder material brought very
3 limited fibrous material with it. And much of the
4 insulation binder was driven off under normal
5 operating conditions of the plant. The binder
6 material is pretty much gone by the time an event
7 would occur.

8 There is also a study of fibrous debris
9 collection on fuel grids. The test conditions were
10 looking at an unheated BWR bundle three meters long
11 with three spacer grids. The flow rate was typical of
12 a post LOCA natural circulation for boiling water
13 reactors, and rockwool debris was used.

14 The rockwool was thermally treated to
15 drive off the binder, and it was disintegrated by
16 small steam jets similar to what some of the debris
17 preparation was described to you over the past day and
18 a half.

19 The observations were that the fibrous
20 debris did collect in spacer grids, and there was some
21 head loss associated with the increase of fiber
22 collection. However, flow continued to be provided
23 through the fiber bed. Again, it did not compress or
24 compact due to the low flow rates running through the
25 fuel.

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1 MR. DINGLER: In addition, we do not know
2 what the length size of those fibers were at this
3 point. so we're doing some looking and saying was it
4 the long three inch, four inch, whatever length or the
5 five millimeters or whatever we came up with today in
6 here on the bypass stuff.

7 MR. ANDREYCHEK: With regards to localized
8 build-up and debris in hot spots, local fuel blockage
9 in broad numbers has been studied under re-flood
10 conditions. The full length emergency core heat
11 transfer test program, 1970 and '71 looked at the
12 blockages. The thermal hydraulic test bundles with
13 balloon rods simulating re-flood phase of a LOCAL as
14 reported in 1977 at the ANS meeting. I believe it
15 was in San Francisco, and the flooding experiments
16 with blocked arrays and a partially blocked 25 rod
17 bundle, 1980 time frame.

18 The initial conditions were at the start
19 of quench high decay heat; heater rod temperatures of
20 at least 1,100 degrees Fahrenheit, maybe higher and
21 various blockage configurations were studied as well
22 as different refluc. rates.

23 The observations were that the presence of
24 up to about 90 percent blockage in the fuel rod
25 bundles themselves actually improved heat transfer

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1 downstream of the blocked area. Due to increased
2 turbulence in mixing of the fluids that move through
3 the bundle, and although this doesn't apply to what we
4 would necessarily be looking at, the break-up of a
5 liquid phase droplets increasing liquid surface break
6 further de-superheat the steam through the bundle.

7 The fundamental issue was that the
8 blockages actually create a turbulence, which improved
9 heat transfer in the fuel bundle.

10 Go back.

11 CHAIRMAN WALLIS: A different kind of
12 blockage than fibrous blockage.

13 MR. ANDREYCHEK: I don't disagree with
14 you, but the fibrous blockage doesn't necessarily form
15 all at one time, and as it forms, you're going to get
16 increased turbulence behind it because you're going to
17 actually constrict the flow. Then it's going to
18 expand up a little bit again. And that increase in
19 turbulence will increase the heat transfer as the
20 blockage arises.

21 MR. CARUSO: That's downstream of the
22 blocked area, but what about in the blocked area
23 itself?

24 MR. ANDREYCHEK: Well, I'm glad you asked
25 that question. I appreciate you being a straight man

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1 for me, Ralph. Thank you.

2 We're also looking at blockage, and
3 effective blockage, at localized areas of the fuel.
4 We've done a calculation so far, one calculation so
5 far that looks at the blockage that forms in a grid.
6 The highest power location was assumed, and the
7 blockage was assumed to be circumferential all the way
8 around the fuel rod in the middle of the grid, and no
9 credit was taken for radial heat transfer to the
10 blockage, i.e., it was a perfect insulator, and the
11 conduction in the clad was in the actual direction.

12 The one calculation done so far is one
13 blockage was evaluated and calculated temperature was
14 sufficiently cool that clad integrity was not
15 challenged.

16 CHAIRMAN WALLIS: So it's the fiberglass
17 and the blockage presumably melts.

18 MR. ANDREYCHEK: If it were fiberglass at
19 the temperatures that we're talking about, yes, it
20 would.

21 MR. DINGLER: We're assuming that it
22 melted or whatever and completely totally insulated.

23 MEMBER MAYNARD: From the tests that we've
24 seen some of the results, this stuff doesn't seem to
25 be packing. It seems to be wet, and I would think

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1 even if you had some localized boiling there, that
2 would actually start moving some of the stuff around,
3 too.

4 MR. DINGLER: That's correct, and that's
5 what we're seeing, too, but we just wanted to do a
6 completely blocked area and see what happens to us.

7 MR. ANDREYCHEK: This is a bounding case,
8 and we just wanted to do a bounding case to see where
9 we're at.

10 Okay. Chemical effect. It's one of the
11 three tasks that we've identified. We want to look at
12 precipitation in particulate deposition on fuel
13 surfaces and precipitation and in particulate
14 deposition on non-fuel surfaces. It could restrict
15 flow, including surfaces such as the reactor vessel
16 inlet baffle region.

17 And finally, precipitation in particulate
18 deposition in fiber beds formed from solid materials
19 that pass through the sump strainers, i.e.,
20 fiberglass.

21 And again, part of this problem statement
22 was written before some of the data that's becoming
23 available now with regards to how this fiber material
24 appears to be collecting on fuel assemblies, which is
25 loose and flocky. It's not really compacting.

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1 Another part of the chemical effects to
2 demonstrate techniques, perform sensitivity analyses
3 for the effects of pH and temperature on solubility of
4 chemical precipitates, and to identify the influence of
5 these parameters on key chemical reactions that would
6 occur.

7 CHAIRMAN WALLIS: There is some concern
8 that this stuff goes through the heat exchangers which
9 are cold; that there would be precipitation in the
10 cold region of the heat exchanger. Are you looking at
11 that, too?

12 MR. ANDREYCHEK: I've looked at that from
13 the integrated chemical effects test, and we didn't
14 see a whole heck of a lot of that. Now, the precipitates
15 that -- and if they do change and you do get some
16 precipitation coming out --

17 CHAIRMAN WALLIS: And the cooling, yeah.

18 MR. ANDREYCHEK: Cooling, and that's
19 always a possibility. That would tend to be diverted
20 into the lower plenum of the reactor vessel. In some
21 cases under very low flow conditions, it would tend to
22 settle out there if you have a hot leg break.

23 CHAIRMAN WALLIS: Played out in the RHR.

24 MR. ANDREYCHEK: The velocities in the RHR
25 system tend to be fairly high, and I would not expect

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1 them to play out because the velocities are on the
2 order of around ten feet per second.

3 CHAIRMAN WALLIS: Well, isn't there an
4 ICET test? They got some played out in the piping,
5 some white material, whatever it was?

6 MR. ANDREYCHEK: You are correct, and
7 there was some I want to call it played out or some
8 material that was deposited there. However -- and
9 here's where the "however" comes in at. So please
10 bear with me.

11 The material was noted after the test was
12 shut down, cooled, and drained. So it's not clear
13 that it was deposited during the test or if it
14 occurred as part of the shutdown of the facility.
15 That same type of deposition that was noted on some of
16 the piping was also noted on the sides of the reactor
17 that was used, the big 250 gallon reactor, and it was
18 very loose and very flocky on the inside of the reactor
19 vessel by and large, and some of it did come off
20 fairly easy.

21 There was one test, I believe, that I
22 think it had to do with fibrous material that got
23 carried through and did bind a flow meter up, but it's
24 not clear to me that the material that actually formed
25 on the piping was due to precipitation because there

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1 was very little temperature change. It stayed
2 relatively isothermal.

3 CHAIRMAN WALLIS: We do know that when
4 they cooled down the test, they did get the --

5 MR. ANDREYCHEK: Exactly, exactly, but
6 that was also under stagnant conditions, and the water
7 was sort of drained down gradually. So it's not clear
8 to me.

9 MR. KLINE: And if I could also clarify
10 from the ICET series, in ICET-1 you're correct. The
11 scale seemed to occur. It was noticed on the tank in
12 other surface areas after it was drained down. In
13 ICET-3 there was what we think was a calcium phosphate
14 that formed on the flow meter during the test and they
15 shut the test down, I believe, around day nine or so
16 to clean it.

17 MR. ANDREYCHEK: Yes.

18 MR. KLINE: All fine from NRR.

19 CHAIRMAN WALLIS: So it did form during
20 the test. Well, did it form there because it was
21 colder there or why did it form in the flow meter?

22 MR. KLINE: It probably wasn't much colder
23 in the piping because it was insulated.

24 CHAIRMAN WALLIS: Because of the flow
25 restriction or something?

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1 MR. KLINE: I think we just generated a
2 huge quantity of calcium phosphate initially, in the
3 early part of that test, and some of it was carried
4 downstream and collected.

5 MR. ANDREYCHEK: I would agree that there
6 was a fair amount of that material that was generated,
7 but it's not clear that what actually caused it to
8 form on that roto-meter was the fact that there was a
9 flow restriction and there was a good site for it to
10 actually collect. I don't know.

11 And, again, the ultimate objective is for
12 the chemical effects evaluation, to demonstrate the
13 long term core cooling is maintained. It may be plant
14 specific. We might have to use plant specific inputs
15 for chemical interactions. We're going to identify
16 some methods to predict precipitation and deposition
17 on relevant core components and perform some sample
18 evaluations to guide plant specific --

19 CHAIRMAN WALLIS: Well, you've talked
20 about these things which might or might not occur, and
21 you folks have got to figure out. You can solve those
22 issues by looking at what's been done before or if you
23 need to do some other tests or whatever. You're going
24 to figure all of that out.

25 MR. ANDREYCHEK: That's correct.

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1 MR. DINGLER: As I say, we're just getting
2 initiated because our screening like the chemical
3 effects, we couldn't screen it out.

4 CHAIRMAN WALLIS: In other words, today is
5 the sort of things you're thinking about having to
6 consider.

7 MR. DINGLER: That's correct.

8 CHAIRMAN WALLIS: You're not really saying
9 that you've resolved the issues.

10 MR. DINGLER: No, we're not saying we've
11 resolved the issues. I wish we could say that.

12 MR. ANDREYCHEK: So do I.

13 CHAIRMAN WALLIS: Well, you could say
14 that.

15 MR. DINGLER: I wish we could.

16 MR. ANDREYCHEK: So in summary,
17 considerable work has already been performed, and the
18 available results indicate success in demonstrating
19 long term core cooling is offered for a wide range of
20 conditions.

21 Additional work has been identified to
22 address the phenomenon in more detail and to refine
23 some analyses while demonstrating there is significant
24 margin for long term core cooling.

25 I'd like to add also that the work on this

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1 project is going to be done jointly with and between
2 AREVA and Westinghouse. It is going to be a joint
3 effort, and some of the materials that I presented
4 here today is a result of AREVA's efforts they've
5 already undertaken, as well as efforts of Westinghouse
6 performed to date.

7 MEMBER BONACA: Now, this includes those
8 CE plants?

9 MR. ANDREYCHEK: That's correct. I
10 consider them Westinghouse at this point since we --

11 MEMBER MAYNARD: Okay. There are some
12 PWRs that had GE fuel, I believe. Are they --

13 MR. DINGLER: From what we understand it's
14 only AREVA and Westinghouse now fuel is at the PWRs.

15 MEMBER MAYNARD: Okay.

16 MR. DINGLER: Is what we've been told.
17 We're trying to find that out, but the plants have
18 told us that's all they have. There's about a 40-60,
19 40-60-40 split right now between the two. And I may
20 be wrong, but that's what I was told.

21 MEMBER MAYNARD: The other thing, I'd like
22 to go back to the flow rates and take a look at those
23 numbers. It does look like what would be in a tech
24 spec would basically boil off rate if you weren't
25 adding any water. There's still valid numbers and

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1 valid trends if your make-up water, and in fact, the
2 cooler you make your make-up water, the less water
3 that you need.

4 So I think the numbers are still
5 representative of what you need, but I do think that
6 what numbers are coming out of the emergency
7 procedures there is what the boil-off rate is at that
8 point.

9 MR. DINGLER: Thank you. I apologize for
10 misleading you by then.

11 MEMBER BONACA: You simulated up to 80
12 percent blockage.

13 MR. ANDREYCHEK: That's correct.

14 MEMBER BONACA: But you would have some
15 boiling probably right above that blockage. I don't
16 understand the hydraulics in the area. You're showing
17 some flow coming through and some of the circulation
18 there.

19 CHAIRMAN WALLIS: Well, this is a sort of
20 porous media model or is this some sort of a --

21 MR. ANDREYCHEK: Actually, this was a
22 finite element model. This was -- the blockage was
23 set right here.

24 CHAIRMAN WALLIS: But what do you about
25 the resistance to cross-flow and the fuel?

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1 MR. ANDREYCHEK: The cross-flow and the
2 fuel is modeled by looking at flow through bundles.

3 CHAIRMAN WALLIS: So it's something like
4 a porous medium.

5 MR. ANDREYCHEK: That's correct. And if
6 you take a look at Idel-chek, you can get loss
7 coefficients for flow through bundles of --

8 CHAIRMAN WALLIS: It's surprising that you
9 get that.

10 MEMBER BONACA: So what did you get it
11 through D? I mean, RELAP-5 doesn't give you -- see,
12 how did you analyze in 3(d), that part above the
13 blockage?

14 MR. ANDREYCHEK: Well, this was a pie
15 sector of a model. We took a look and basically used
16 the bisector. We didn't try to model the entire core.
17 And, again, we're using symmetrical blockages starting
18 at 20 percent centered in the middle, then 40, 60, 80
19 as shown in the previous diagram.

20 MEMBER BONACA: Oh, I see what you mean.

21 MEMBER MAYNARD: Even if you had no flow
22 coming in at all, as long as you have water above the
23 core you would get some boiling, but you're going to
24 maintain and stay below your limits of cladding
25 temperatures as long as you've got water. So you're

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1 getting some recirculation and stuff in there.

2 MEMBER BONACA: What I don't understand is
3 how did they do the prediction. I mean, you mentioned
4 TRACE and RELAP 5.

5 MR. ANDREYCHEK: For this particular
6 calculation that was used a finite element code, it
7 was not TRACE. It was not RELAP 5. It was a finite
8 element code to look at flow and flow redistribution.

9 CHAIRMAN WALLIS: Would you go back to
10 that picture you just showed us of the finite element
11 output? Somewhere behind Mo here there's a stagnation
12 point.

13 MR. ANDREYCHEK: The recirculation pattern
14 here.

15 CHAIRMAN WALLIS: Where that recirculation
16 pattern meets the main flow, there has to be a
17 stagnation point down on the bottom there.

18 MEMBER KRESS: Right in the middle.

19 CHAIRMAN WALLIS: Right in the middle. So
20 presumably particulate matter would come around and go
21 around that vortex and deposit down in that stagnation
22 area just like snow behind the fence or something, the
23 vortex. So it might build up particles by settling in
24 the regions of very low velocity in there.

25 MR. ANDREYCHEK: It's a possibility, but

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1 I would suggest if you've got blockage, Dr. Graham, we
2 did some calculations and we're looking at some
3 boiling here. That becomes a very energetic and very
4 chaotic process.

5 CHAIRMAN WALLIS: You do have particles in
6 this flow, don't you?

7 MR. ANDREYCHEK: In this particular
8 calculation --

9 CHAIRMAN WALLIS: But you don't throw out
10 particles because some of the particles go through.

11 MR. ANDREYCHEK: That's correct.

12 CHAIRMAN WALLIS: All right. So that
13 you'd have to consider what they do in this, as well
14 as what the fluid does.

15 MR. ANDREYCHEK: That's correct.

16 MEMBER BONACA: That's the point I was
17 trying to make before. It would be very energetic.
18 You would have probably removal or lifting of
19 blockage, too.

20 MR. ANDREYCHEK: Not only that, but
21 depending on the bubbles and how the bubbles would be
22 moving, there might even be a forcing function down to
23 actually push fibrous debris off the grids and open up
24 the grids again.

25 CHAIRMAN WALLIS: Dangerous for you to

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1 hypothesize all of these mechanisms because then we
2 will now turn around and 'say, "Well, analyze them."

3 MR. ANDREYCHEK: I understand. I realize
4 that.

5 (Laughter.)

6 MR. DINGLER: That's another reason I'm up
7 here.

8 MR. ANDREYCHEK: That's right. But this
9 was a calculation we had done several years ago
10 looking at this.

11 Any other questions?

12 CHAIRMAN WALLIS: Can we believe these
13 calculations or do we have to do some sort of test?

14 MR. ANDREYCHEK: I don't think we need to
15 do a test. I think we can believe them, and there is
16 data to --

17 CHAIRMAN WALLIS: It may be approach to
18 all of the strainers, is to base everything on tests
19 because we really have difficulty predicting.

20 MR. ANDREYCHEK: Okay.

21 CHAIRMAN WALLIS: Are you going to say
22 that cores are different and we can predict what
23 happens? We don't need any tests?

24 MR. ANDREYCHEK: I'd like to say that I've
25 a very strong belief the multi-dimensional

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1 capabilities of advanced codes and there's a
2 sufficient amount of data out there that looks at
3 blockage in the flow paths.

4 MEMBER MAYNARD: Has there been some
5 testing done with blockage in the past on fuel
6 assemblies?

7 MEMBER KRESS: There was a lot of testing
8 with the liquid-metal cooled reactors.

9 MR. ANDREYCHEK: That[s correct.

10 MEMBER KRESS: Because they expected it
11 there, and of course, it's a different core
12 configuration and a different coolant.

13 MR. ANDREYCHEK: That's correct.

14 MEMBER KRESS: But a lot of data there.

15 MR. ANDREYCHEK: Yes, there is, and in
16 fact, that's what happened in FERMI Unit 1, was a
17 blocked part of the port.

18 MEMBER KRESS: Yeah, that's what brought
19 it on actually.

20 MR. ANDREYCHEK: Yes.

21 MEMBER MAYNARD: Was the recent event at
22 PAKS at all instructive on this?

23 MR. ANDREYCHEK: PAKS? I'm not familiar
24 with it. So you're going to have to help me, please.

25 MR. CARUSO: The Hungarian reactor where

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1 they had some bundles isolated in a cleaning chamber
2 overnight and they turned off the cooling to it, and
3 it got very messy.

4 MR. ANDREYCHEK: I'll be honest with you.
5 I am not familiar with that scenario at all. So if
6 you can give me a reference, I'd be more than glad to
7 look at it, but I'm not familiar with it.

8 MR. CARUSO: P-A-K-S. Happened about two
9 years ago.

10 MEMBER MAYNARD: It had water over it, and
11 it was still --

12 MR. ANDREYCHEK: I've got it. I am not
13 familiar with it. I'll be more than glad to take a
14 look at it. I'll talk to our fuels people.

15 CHAIRMAN WALLIS: Of course, you don't
16 know where the blockage is going to be, do you either?
17 You've got an 80 percent blockage that you sort of
18 have at a certain place.

19 MR. ANDREYCHEK: You're correct, yes.

20 CHAIRMAN WALLIS: So one would have to do,
21 I suppose, a whole lot of sensitivity calculations
22 about where the blockage might be and so on.

23 MR. ANDREYCHEK: That's entirely possible.
24 Again, we were looking at what we had available to
25 help guide us to say does this look like a reasonable

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1 success path. We believe we have sufficient data and
2 sufficient capability to find a success path.

3 CHAIRMAN WALLIS: You're not looking at
4 bypass flows coming in in some way? There was some
5 talk earlier about even if you've got 100 percent
6 blockage, you get have got water in there.

7 MR. ANDREYCHEK: That is correct. There
8 are some designs that have the capability of doing
9 that, yes.

10 MR. DINGLER: And we may use that yet.
11 We're seeing if we can take the next step and then we
12 may have to take the next step on down.

13 MR. ANDREYCHEK: This appears to represent
14 a limiting configuration to look at. If we can be
15 successful here then the rest is margin.

16 CHAIRMAN WALLIS: Well, its' still work in
17 process and interesting to see how it comes out.

18 MR. ANDREYCHEK: Thank you, and I
19 appreciate the insights on the PAKS, Ralph. Thank
20 you.

21 Any other questions?

22 CHAIRMAN WALLIS: I assume there will be
23 some sort of WCAP or something at the end of it all.

24 MR. ANDREYCHEK: There will be a report,
25 yes.

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1 CHAIRMAN WALLIS: Is there some time
2 schedule for that? Do you have a plan?

3 MR. DINGLER: We're working with the staff
4 to work through that right now.

5 CHAIRMAN WALLIS: But it will be some
6 time, won't it?

7 MR. ANDREYCHEK: Yes.

8 MR. DINGLER: We have been requested by
9 the staff to work very closely with them as we develop
10 this to make sure we're not far off when we get done.

11 MR. SCOTT: Mike Scott again.

12 Obviously the publication date of that
13 document is of great interest to us, given the
14 December 31st, '07 goal for resolving the generic
15 letter.

16 CHAIRMAN WALLIS: Well, it will be January
17 1st, 2008.

18 MR. SCOTT: We are pushing. They're
19 probably saying we're pushing them pretty hard to get
20 busy on this and get a product out as soon as they
21 can.

22 MR. DINGLER: And we figure this probably
23 won't be the last time we're up in front of you to
24 discuss this either.

25 MEMBER MAYNARD: At this point is there

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1 any international cooperation going on with your
2 plants or is this primarily --

3 MR. ANDREYCHEK: It's primarily U.S.
4 plants.

5 Any other questions?

6 CHAIRMAN WALLIS: Then we're finished.
7 Thank you very much.

8 MR. ANDREYCHEK: Well, thank you. We
9 appreciate the attention and the questions. Thank
10 you.

11 PARTICIPANT: Do you want to keep going?

12 CHAIRMAN WALLIS: I think we should keep
13 going. We've been going for less than an hour. Is
14 staff ready? Do you have your reg. guides and SRPs
15 and everything all ready for this problem?

16 PARTICIPANT: We're working on it.

17 (Whereupon, the foregoing matter went off
18 the record at 1:53 p.m. and went back on
19 the record at 1:54 p.m.)

20 MR. SCOTT: Before the staff begins their
21 presentation I wanted to just make a few introductory
22 remarks.

23 The subject matter for the next hour or so
24 is licensing activities related to GSI-191. The
25 activities that we're planning to discuss with you are

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1 actually two types. One is license amendment requests
2 that are before the staff or have been, and the other
3 is extension requests to resolve the issues in Generic
4 Letter 2004-02.

5 So Ruth Reyes, who is sitting at the front
6 there of the SSIB staff in NRR, is going to present to
7 you a summary of all of the license application
8 requests except one, and that one being Palisades in
9 which you all had expressed particular interest, and
10 for that one Mark Padovan to your right here is going
11 to present the Palisades license amendment request
12 after Ruth has summarized the others.

13 There are about eight license amendment
14 requests that she's going to talk about, and most of
15 those involve a considerable cast of NRC reviewers,
16 and I'd like to thank that considerable cast who are
17 mostly present in the room with us right now, but
18 because of the number of involved parties, it is
19 possible that you may have a question that we're not
20 prepared to answer because that particular individual
21 may not happen to be here.

22 Should that happen to be the case, we'll
23 provide you additional information as soon as it
24 becomes available.

25 The other presenter that you see in front

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1 of you is Leon Whitney, also of the SSIB staff, and
2 Leon will be talking to you towards the end of Ruth's
3 presentation about the extension request that the
4 staff has be reviewing and some of which the staff has
5 approved in recent months.

6 So that's what we're going to be
7 discussing with you.

8 And with that, Ruth.

9 CHAIRMAN WALLIS: Okay. Thank you.

10 MS. REYES: Good afternoon, everyone. My
11 name is Ruth Reyes from NRR in the Safety Issue
12 Resolution Branch.

13 The purpose of this presentation like Mike
14 said is to inform about the license amendment request
15 that address in SSIB 191, and we're also going to
16 discuss the staff's review of licensee request to
17 extend completion of Generic Letter 2004-02,
18 corrective actions beyond December 1st, 2007.

19 In response to the GSI-191 and the Generic
20 Letter 2004-02, the licensees -- sorry. Like I was
21 saying, in response to the GSI-191 and the Generic
22 Letter 2004-02, the licensees reanalyzes the
23 containment sump, and as a result of the analysis some
24 licensees determined that they had to make some
25 changes on their technical specifications, and there

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1 was one licensee that identified that they had to make
2 some changes on the evaluation methodology that they
3 have in their UFSAR.

4 The license amendment request that I will
5 be discussing are the Millstones, Fort Calhoun, Surry,
6 Sequoyah, Robinson --

7 CHAIRMAN WALLIS: I'm not quite sure
8 what's going on here. I thought this entire process
9 was a change in evaluations. The whole way of
10 analyzing sumps has been changed as a result of this
11 GSI, hasn't it?

12 It used to be that you were allowed to
13 assume that half of the screen was blocked and all of
14 that sort of thing. The whole regulation has changed,
15 hasn't it?

16 MR. SCOTT: The regulation has not
17 changed. In most cases the methodologies that are
18 involved here are not described or at least the
19 licensees have not identified them as being described
20 in the FSAR, which of course is one of the criteria
21 that triggers a license amendment request. That's why
22 we have 69 plants that are out reevaluating this
23 issue, but we only have eight or nine license
24 amendment requests so far.

25 We're likely to get others.

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1 CHAIRMAN WALLIS: It's a kind of technical
2 question really, isn't it? It's regulatory technical,
3 whether or not something happens to be -- an FSAR
4 needs to be changed, and so on.

5 MR. SCOTT: It's in accordance with 10 CFR
6 5053.

7 CHAIRMAN WALLIS: In general, all of the
8 plants are reevaluating everything.

9 MR. SCOTT: Absolutely.

10 CHAIRMAN WALLIS: Okay.

11 MR. SCOTT: And excuse me. I understand
12 one more thing. To the extent that some plant
13 modifications end up being implemented, for example,
14 to change out a pH blocker, if that's described and
15 they make the decision that they need to change out
16 their pH buffer, then we're going to be getting
17 potentially a large number of LARs related to that.

18 MS. REYES: So the last ones are Robinson,
19 Comanche, Catawba, McGuire and Palisades.

20 The first one that I'm going to talk about
21 is Millstone. This last summer request proposed to
22 delay the initiation of the (unintelligible) gray
23 system pumps. With this change they want to increase
24 the NPSH margin.

25 Currently the Millstone --

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1 CHAIRMAN WALLIS: How does it increase the
2 NPSH margin?

3 MS. REYES: Through the (unintelligible)
4 spray pumps.

5 MEMBER KRESS: Is that spray on automatic
6 actuation?

7 MS. REYES: Right now what they have is
8 based on after they get the containment high pressure
9 signal, and there's a delay timer. They want to
10 change it to start the pumps --

11 MEMBER KRESS: Change the delay timer.

12 MS. REYES: They want to change the delay
13 timer. They don't want to use the delay timer. What
14 they want to do, automatic after they get the
15 containment high pressure signal and the RWST low
16 level signal.

17 MEMBER KRESS: It will still be on
18 automatic.

19 MS. REYES: It will be on automatic, yes.

20 CHAIRMAN WALLIS: Now, I'm trying to get
21 the connection between the first bullet and the
22 second.

23 MEMBER KRESS: It allows the containment
24 temperature and pressure to increase more.

25 CHAIRMAN WALLIS: Well, the increase in

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1 temperature decreases your MPSH. Unless you get
2 containment credit, you don't get any pressure.

3 MEMBER KRESS: Yeah, but the pressure goes
4 up.

5 CHAIRMAN WALLIS: Unless you get
6 containment pressure with it.

7 MR. LOBEL: this is Richard Lobel from the
8 staff.

9 I wasn't the reviewer, but judging from
10 the way subatmospheric containments work and Millstone
11 is slightly atmospheric and they were designed that
12 way; delaying the recirculation spray pumps would
13 allow more time for the level to increase. The
14 recirculation spray pumps start very early.

15 CHAIRMAN WALLIS: So it's the -- that
16 increases the NPSH.

17 MR. LOBEL: Yes.

18 CHAIRMAN WALLIS: Okay. It's not a
19 temperature and pressure effect at all.

20 MR. LOBEL: Probably not.

21 CHAIRMAN WALLIS: We don't know.

22 MR. LOBEL: Most likely it's just waiting
23 longer until you have more water on the floor and in
24 the sump. That's the effect.

25 CHAIRMAN WALLIS: But it might be altered

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1 by then. So it's not clear which way things will go.

2 MR. LOBEL: It's not going to be too much
3 colder. I don't know. Maybe Westinghouse has
4 something to add.

5 CHAIRMAN WALLIS: There's some data we
6 can't tell.

7 MR. LOBEL: I would say it's a pretty good
8 bet that that's what it is.

9 MEMBER KRESS: It's hard to believe
10 they're (unintelligible).

11 CHAIRMAN WALLIS: It's going to make the
12 temp and pressure higher, isn't it?

13 MEMBER KRESS: Right. Wait longer to turn
14 the sprays on.

15 MR. SCOTT: Now, correct me if I'm wrong
16 here. This reactor has two spray systems, right?
17 They have an injection spray systems, right?

18 MS. REYES: Yes.

19 MR. SCOTT: They have an injection spray
20 system and they have a recirculation spray system. So
21 you're spraying the whole time.

22 MS. REYES: There's another set up
23 containment spray pumps that are going to start right
24 after the containment high pressure signal.

25 MEMBER KRESS: Okay. I take it all back

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1 then.

2 MR. LOBEL: The recirculation pumps are
3 taking suction from the floor of -- the other spray
4 system is taking suction from the RWST.

5 MEMBER KRESS: That makes a lot of sense.

6 CHAIRMAN WALLIS: Okay, okay.

7 MS. REYES: So there's no adverse impact
8 on containment temperature or pressure expected with
9 this change.

10 CHAIRMAN WALLIS: Well, just wait a
11 minute. If you turn the pumps on it doesn't
12 necessarily change the level very much. The water
13 goes up and comes back down again.

14 MR. LOBEL: You're just allowing more
15 water to accumulate.

16 CHAIRMAN WALLIS: Before you turn them on,
17 before you stop. Okay, and that comes from the RWST
18 then.

19 MR. LOBEL: From the RWST and from the
20 break.

21 MS. REYES: The second license amendment
22 request is Fort Calhoun. They propose to reduce the
23 required number of containment spray pumps, and with
24 this they're going to increase the NPSH margin. Right
25 now the Fort Calhoun containment spray system pumps

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1 consist of three pumps, and two of those three pumps
2 share the same suction line. So they want to disable
3 the activation signal for automatic start for one of
4 those two pumps.

5 And again, there's no significant adverse
6 impact on either containment temperature or pressure
7 expected with this change.

8 For Surry, they want to change the method
9 for starting the inside and outside recirculation
10 spray pumps. Currently what they have is like
11 Millstone has. They have delay timer after they get
12 the high pressure in the containment. They want to
13 wait until they get the high pressure in containment,
14 also a low level signal for RWST.

15 And there's no significant adverse impact
16 on containment temperature or pressure expected with
17 this change.

18 CHAIRMAN WALLIS: Well, are those the only
19 things that are getting impacted by this sort of
20 thing?

21 MR. SCOTT: Well, now, here again, the
22 license amendment requests are going to have narrow
23 scope related to what appears in the SR. Surry
24 turning in this particular discussion or this
25 application here does not in any way mean that there

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1 aren't myriad other issues associated with this. It's
2 just that they don't come up as FSAR items.

3 CHAIRMAN WALLIS: Presumably you have to
4 evaluate all of the consequences of this change, not
5 just the effects on containment, temperature and
6 pressure.

7 MR. SCOTT: Okay. I misunderstood your
8 question. Are we implying by these limited slides
9 here that these are the only considerations taken?
10 No.

11 CHAIRMAN WALLIS: Well, there was other
12 things.

13 MR. SCOTT: Yes, that's right. Again, we
14 had a relatively short presentation time here, and so
15 we attempted to identify what the key point is that's
16 being made here, and as was pointed out, each of these
17 license amendment requests involves a number of
18 reviewers, some of whom are here.

19 So if you have a particular question about
20 a consideration, we can answer it.

21 One other thing to bear in mind is most
22 all of these are still under review.

23 CHAIRMAN WALLIS: Now, are they asking to
24 be able to make these changes before or after they
25 install the new strainers?

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1 MR. SCOTT: I don't know for each one of
2 these. In general, they are asking to do these
3 changes in conjunction with installing the new
4 strainers.

5 CHAIRMAN WALLIS: Did it go along with the
6 change in the strainers or do they want to do it now
7 before they change anything because there's a benefit?

8 MR. SCOTT: It depends. It varies from
9 request to request.

10 CHAIRMAN WALLIS: But it's not a
11 consequence of having new strainers that they want to
12 do this?

13 MR. SCOTT: In some cases it is.

14 CHAIRMAN WALLIS: It might be.

15 MR. SCOTT: That's right.

16 CHAIRMAN WALLIS: -- in with how the
17 strainers work. So you have a lot of work to do to
18 evaluate it.

19 MR. SCOTT: In some cases they are
20 independent of the strainer activities and in some
21 cases they're not. As we go through the rest of them,
22 I think you'll see it's kind of a mixed bag.

23 The ones that you see, most of the ones
24 that Ruth has discussed so far related to what has
25 been loosely referred to as water management, that

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1 these are good things to do regardless of the presence
2 or absence of a new strainer.

3 CHAIRMAN WALLIS: Well, you're telling us
4 all of this. Is there any input from us that you
5 would expect or which we could possibly give you which
6 might be useful?

7 MR. SCOTT: If you --

8 CHAIRMAN WALLIS: Were you aware that
9 these things are happening?

10 MR. SCOTT: This was meant to update you
11 on what's going on with these. Obviously we're always
12 interested in hearing your input on these. If there's
13 something that we need to discuss, we can.

14 CHAIRMAN WALLIS: -- what's going on, we
15 can't really give you much feedback.

16 MR. SCOTT: Maybe a good way to leave this
17 is because we're going over eight of them actually in
18 a half an hour period and we don't have a lot of time
19 for in depth discussion of any one of them, if there
20 is a particular aspect that piques your interest or
21 concern, then we can come back to you another day and
22 speak to that in more detail.

23 CHAIRMAN WALLIS: It might be a concern
24 that you have with some of them you could tell us
25 about.

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1 MR. SCOTT: Okay. I would suggest we go
2 through the rest of the presentations.

3 MEMBER MAYNARD: So far it has primarily
4 been a water management issue and NPSH. Do any of
5 these have any chemical injection with their
6 containment spray or is this all just water?

7 I'm looking at any radiation effects.
8 Some of the containment spray systems do more than
9 just cool.

10 MR. LOBEL: This is Richard Lobel of the
11 staff.

12 Usually there's chemicals in the spray
13 water for the PWRs.

14 MEMBER MAYNARD: And my question kind of
15 gets back to we talk about pressure and temperature
16 effects. I take it that there's no adverse exposure
17 consequences either.

18 MR. LOBEL: That's one of the things
19 that's addressed by the licensees in these. They
20 would have to address any changes in their dose
21 methodology or calculations or conclusions.

22 MR. KLINE: Paul Kline.

23 I think one of the amendments that Ruth
24 will get to in a minute here relates to a change of
25 request also that has to do with a potential change in

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1 a buffering agent

2 MS. REYES: The next one is Sequoyah.
3 Sequoyah requested a license amendment to change an
4 evaluation methodology on their UFSAR. This revised
5 analysis includes development of a three dimensional
6 CFD model of the debris transport in the sump pool.
7 This three dimensional model sizes the flow area for
8 an advanced sump strainer design which will replace
9 the Sequoyah's original sump intake structure.

10 CHAIRMAN WALLIS: I thought from
11 everything we heard in the last few days that these
12 blenders were mixing up everything to make sure
13 everything got to the strainer, to be conservative,
14 and this whole business about how much stuff got
15 transported was irrelevant.

16 Now you're saying that here are these
17 folks who want to make it a key part of their strainer
18 design.

19 DR. LU: Shan Lu from NRR.

20 Actually a lot of licensees are using the
21 CFD to reduce certain fraction of the debris transport
22 to the sump. Some of them are taking or using
23 conservative assumptions.

24 CHAIRMAN WALLIS: They want to take credit
25 for this.

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1 DR. LU: Yes, they do. In this particular
2 plant, the licensee does, takes credit.

3 CHAIRMAN WALLIS: But the people that we
4 heard from the last couple of days seemed to make
5 great efforts to stir everything up and make sure
6 nothing settled out and everything went to the screen.

7 MR. SCOTT: That's partly because the
8 staff has been pressing them if they are making
9 assumptions about what doesn't get to the screen to
10 justify it, and in some cases, as they stated, it's
11 easier to just dump it all on the screen rather than
12 justify the amount that doesn't get there.

13 So you have a mixed bag here. Some are
14 trying to take credit for it. Others are not.

15 MR. LEHNING: This is John Lehning from
16 the NRR staff.

17 I just wanted to point out that the
18 process of doing evaluation of what gets to the sump
19 is a little bit different than this head loss testing.
20 So when you're doing this evaluation, you'd calculate
21 the amount of debris generated and then you'd
22 calculate what gets to the sump screen, and that's
23 what the CFD part is form.

24 When you do the head loss testing, it's
25 taking that amount of debris that you calculated in

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1 your calculation as transporting and then when you do
2 that head loss testing if you take credit for
3 settling, it's crediting settling again after you
4 already did this analytical credit for it. So it's
5 like a different issue. It's not this near field
6 settling issue.

7 CHAIRMAN WALLIS: So far all we see is
8 this is something they're applying for. We don't see
9 a presentation of how good it is or how bad it is or
10 anything. You're just being informed that this is
11 what they're doing.

12 DR. LU: Yes, that's right.

13 CHAIRMAN WALLIS: And do you want us to
14 say that we think it's a great idea or not?

15 MR. SCOTT: Which is a great idea? Any
16 particular item on here?

17 CHAIRMAN WALLIS: To do this kind of
18 thing.

19 MR. SCOTT: Like the last one here for
20 Sequoyah?

21 CHAIRMAN WALLIS: Yeah.

22 MR. SCOTT: Well, the staff views that as
23 not an item of particular concern, that particular one
24 that you just did.

25 CHAIRMAN WALLIS: Do you feel confident

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1 that you can review this application and make a proper
2 decision?

3 MR. SCOTT: Yes.

4 CHAIRMAN WALLIS: Without presenting
5 anything to us?

6 MR. SCOTT: Yes.

7 CHAIRMAN WALLIS: Okay. Shall we move on
8 then?

9 MR. SCOTT: I guess I'd have to take
10 slight issue with your wording. We are presenting it
11 to you, but again, the constraints of this type of
12 presentation is there are a large number of
13 applications.

14 CHAIRMAN WALLIS: I know. I'm just
15 wondering how we add value to this whole process. If
16 you're going to say we have some concerns about this
17 3D calculations and so on and we'd like to bring it to
18 you guys for advice. Are you going to do that or are
19 you just going to go ahead?

20 MR. SCOTT: We're going to show you one
21 that we do have concerns with here in a minute.

22 CHAIRMAN WALLIS: So that's where we can
23 help you. If there's something you are concerned
24 about and we can be of use.

25 MR. SCOTT: Okay. Fair enough. Thank

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1 you.

2 CHAIRMAN WALLIS: We don't particularly
3 like to raise concerns that you don't have. We don't
4 particularly like to do that.

5 MS. REYES: The next one is Robinson.
6 Robinson (unintelligible) strainer, and this license
7 amendment is requesting to replace the phrase "trash
8 racks and screens" in the tech specs with the term
9 "strainers."

10 CHAIRMAN WALLIS: I'm going to need about
11 an hour's discussion on this.

12 (Laughter.)

13 MR. SCOTT: Well, this one is not trivial
14 if you think about it. Go ahead, Ruth.

15 MS. REYES: And the staff review for this
16 license (unintelligible) to insure that replacement
17 strainers are functionally equivalent to existing
18 trash racks and screens.

19 Other plants that have applied or plan to
20 apply, the replacement of the phrase "trash racks and
21 screens" are Oconee, which has already been approved,
22 Wolf Creek, Calloway, and Comanche Peak.

23 MR. SCOTT: To expand on that one a little
24 bit, trash racks, the existing trash racks have a
25 definite role in protecting the existing strainers.

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1 If the trash racks are going to disappear and they're
2 not going to be providing that role for the new, very
3 different strainers that are going to replace the
4 screens, then we're expecting the licensees to show
5 that the strainers are able to handle the various
6 issues related to the absence of the transracks, such
7 as materials impinging on the strainers that would
8 have been blocked by the trash racks had they been
9 there.

10 CHAIRMAN WALLIS: Now, the word "screen"
11 has bene used in all of this as far as I can remember
12 for the last year or two while we've been writing all
13 of these letters and we've had all of these meetings.
14 Suddenly they're being called strainers. That's the
15 big change.

16 MR. SCOTT: There seems to be use of both
17 words in discussing both the new and the old
18 configurations, and if all it says was we're changing
19 our screen to a strainer, that would largely be
20 semantics, but there's more to it than that.

21 First of all, you do have the presence and
22 the existing configuration of trash racks, which won't
23 be around for some of the new configurations, and of
24 course, the screen, the way we kind of thought of it
25 was the screen is the mesh sort of, well, screen --

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1 PARTICIPANT: Perforated plate.

2 MR. SCOTT: Well, the strainer is the
3 perforated plate. So but is that defined in Webster's
4 somewhere? I'm not so sure.

5 CHAIRMAN WALLIS: I think strainer is an
6 attempt to make this more culinary.

7 (Laughter.)

8 MR. SCOTT: Well, I don't have a better
9 explanation.

10 MEMBER BONACA: You may have addressed it
11 already, but it is confusing to me. I mean we have
12 seen over a day and a half of presentations, plus,
13 that a lot of these issues are not closed yet. I mean
14 there are still elements to be brought in, chemistry
15 effects, other effects.

16 And now you're presenting us changes to
17 these plans and making the tech specs or whatever to
18 reflect already some changes for GSI 181. I would
19 expect that they may still have to make additional
20 changes.

21 MR. SCOTT: Absolutely correct.

22 MEMBER BONACA: So this is just interim
23 changes for the tech specs to address things they have
24 done or want to do, not necessarily closure on GSI-181
25 on their part, right?

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1 MR. SCOTT: That is absolutely correct.
2 As we have said in past briefings to the committee,
3 the staff believes that, of course, GSI-191 is a very
4 complex issue. As you have heard, we are not near the
5 finish line of this issue. However, if the choice is
6 to wait until we get to the finish line and then
7 enlarge the strainers or enlarge the strainers and
8 reduce the risk and then get to the finish line, we've
9 chosen the latter.

10 And so everybody going into this knows
11 that the larger strainers may not be the complete end
12 state. As you all were talking about, there may be
13 changes in the pH additive. There will likely be
14 additional plant modifications to remove problematic
15 materials. There's a long way to go here, but we
16 believe that, again, the right answer is to increase
17 the strainer size, and these amendments that you see
18 here are likely -- you know, if we're going to approve
19 them, it's because we believe that they are the right
20 thing to do regardless of how this issue turns out.

21 MEMBER BONACA: So, I mean, this is
22 because they are a regulatory requirement that says if
23 you want to implement this change, though it may not
24 be the final one, okay, you have to submit an
25 amendment request and do that now. Okay?

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1 MR. SCOTT: Right.

2 MEMBER BONACA: That's the reason why it's
3 happening. All right.

4 MR. SCOTT: Right. This is per 10 CFR
5 5059, and they want to make a change to the plant.
6 they have to review it for these various
7 considerations, and the ones you see here have come up
8 with, you know, -- the gate has sent them to they need
9 to ask the NRC for approval to make the particular
10 change they have in mind.

11 MR. WHITNEY: This is Leon Whitney, NRR.

12 However you define strainer or screen, if
13 you're installing what you believe is a strainer in
14 place of trash racks and a screen, I don't think you
15 legally can come out of your outage having done that
16 without getting this change.

17 MEMBER MAYNARD: Right. That's what to me
18 some of these may seem somewhat I won't say trivial,
19 but they're more than that. If it's part of your
20 license you have to have that change before you can
21 actually implement. Some of the modifications, as
22 long as it's improvement in the overall safety, can be
23 implemented, but if there's other things that are part
24 of the license involved in it, that license amendment
25 has to be submitted and approved before you can do it.

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1 MR. WHITNEY: To the extent that the sum
2 total of all the concerns about water management come
3 out positive, you'd want to go ahead regardless of
4 whether you have the old screen or the new one.

5 MEMBER BONACA: I understand that. In
6 some cases like this one here, you know, the guy has
7 replaced the strainers. So I understand. He has to
8 submit an amendment, thought it may not be the final
9 solution, but still.

10 In other cases, it seems to me they could
11 have waited to propose the change until they had the
12 full solution, but they chose to, I guess,
13 implement -- I was looking at the minutes on LAR.

14 MR. SCOTT: Well, remember if you look at
15 this one, for example, I don't know when Robinson is
16 putting in their new strainer, but let's assume
17 they're putting it in in spring '07. Then as Leon
18 said, they need this change in place before they start
19 up after that outage.

20 Also, please recall that starting this
21 fall, we're going to see a significant number of
22 installations of new strainers. The bulk of the new
23 strainers are going to happen in fall '06, spring '07,
24 and fall '07. So there are going to be a lot of these
25 that are going to need to come in well in advance of

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1 the December 31st, '07 deadline for resolution of the
2 generic letter.

3 CHAIRMAN WALLIS: They're all going to
4 come in and say, "Please change the word 'screen' to
5 'strainer'?"

6 MR. SCOTT: I don't believe we're going to
7 get any like that. We don't have any. Again, if
8 somebody just came in and said "screen to strainer,"
9 then I would likely -- my inclination would be to say
10 that that was semantics unless they described what
11 "screen" meant.

12 CHAIRMAN WALLIS: It says "trash racks and
13 screens."

14 MR. SCOTT: If it says "trash racks," then
15 you have a component that's no longer there.

16 CHAIRMAN WALLIS: Okay.

17 MS. REYES: The next one is Comanche Peak.
18 This LAR proposes to lower the value of the low level
19 set point in the RWST, and it also revised
20 (unintelligible) requirements to allow use of
21 alternative containment spray bulkers (phonetic).

22 The staff is currently discussing scope of
23 this LAR with the licensee.

24 MR. SCOTT: And this is one that we do
25 have some questions about because it seeks to allow

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1 use of alternate containment spray buffers
2 unspecified, to be decided in the future, and so as
3 Ruth said, we're currently discussing this one with
4 the licensee.

5 MS. REYES: The next one --

6 CHAIRMAN WALLIS: Well, it can't go much
7 further usually on the low, low level set point per
8 RWST, which is pretty close to the point where they
9 suck in air and stuff. Usually there's not much
10 flexibility with the low, low level, is there?

11 DR. LU: That's right, and that's one of
12 the issues we are looking into as a part of the review
13 related to the war taxing.

14 MS. REYES: The next one is the
15 Catawba/Mcguire. They want to implement an additional
16 manual operator action that would allow operators to
17 manually start one air return fin. With this they
18 preclude the use of containment spraying for many
19 small break LOCAs.

20 MR. CARUSO: Could you explain that?

21 MS. REYES: Okay. Well, if they start the
22 air fins before they normally do, you are lowering the
23 temperature and pressure.

24 CHAIRMAN WALLIS: What does the air return
25 fan connect to?

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1 MR. HAFERA: Excuse me. It's Tom Hafera
2 from staff.

3 This is an ice condenser containment. So
4 starting the air return fan will drive more flow
5 through the ice condenser and, therefore, you reduce
6 containment temperature and pressure.

7 MR. LOBEL: This is Richard Lobel.

8 What Tom said, it increases the amount of
9 ice melt.

10 CHAIRMAN WALLIS: Right. That's right,
11 but it wouldn't apply to another kind of plant at all,
12 would it?

13 MR. LOBEL: No. Well, no other plant has
14 these fans. There aren't the fan coolers. These are
15 special fans in an ice condenser.

16 CHAIRMAN WALLIS: Thank you.

17 MR. WHITNEY: Leon Whitney, NRR.

18 I'd like to give you a survey or summary
19 for your information on extension requests under 4 GSI
20 191. Generic Letter 2004-02 corrective actions are
21 due by 12/31/07.

22 SECY-06-0078 provided new extension
23 criteria. One, the licensee must have a plan for
24 resolution of outstanding technical issues with
25 margins. It must have mitigative measures, and

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1 provide temporary improvement to sump or containment
2 materials.

3 And eight requests have been approved out
4 to spring --

5 CHAIRMAN WALLIS: On the mitigated
6 measures, mitigated measures sounds like a sort of
7 catch all thing. Is this --

8 MR. WHITNEY: I can discuss what one --

9 CHAIRMAN WALLIS: -- some criterion about
10 what they have to achieve to be acceptable or
11 something?

12 MR. SCOTT: Leon, these would be
13 consistent with the bulletin, right?

14 MR. WHITNEY: Well, the bulletin and other
15 things. One of the rationales the licensee gives is
16 that we have done the bulletin mitigated measures, for
17 example, but they give many others.

18 CHAIRMAN WALLIS: But then they have to
19 achieve something with those measures which is
20 acceptable.

21 MR. WHITNEY: Yes, and I happen to have a
22 listing of representative ones for you, which I'll
23 give you.

24 CHAIRMAN WALLIS: How do you decide if
25 they're enough? That's my question.

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1 MR. WHITNEY: This is a qualitative
2 review. It is not a quantitative review. We thought
3 of having strict quantitative reviews and found it to
4 be much too cumbersome and we thought we could do an
5 adequate job on a qualitative basis.

6 CHAIRMAN WALLIS: Well, there isn't
7 something which says at the risk of failure long term
8 quilting (phonetic) must be reduced to a certain --

9 MR. WHITNEY: It's not risk based or risk
10 informed.

11 MR. SCOTT: Let me speak a little bit to
12 management's views on this. The requests that have
13 come in to date are asking for basically extending
14 their full completion of generic letter actions out a
15 matter of two to three months, out into the spring '08
16 outages. In essentially all of the cases, and Leon
17 will talk about this some more, but in essentially all
18 of the cases these plants are telling us, "We're
19 installing our strainers now in fall '06." These are
20 mostly fall '06 outages plants. "We're going to have
21 our new strainers in in fall '06, but there's some
22 other issue out there," which Leon will talk about,
23 "that we won't be able to get to in fall '06. So we
24 are 90 percent of the way there."

25 The staff's view on it is that having the

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1 strainer installed in '06 and waiting until spring '08
2 to get to the finish line is better than saying no to
3 these requests and having somebody wait until December
4 '07 and then shut down and do the whole thing.

5 CHAIRMAN WALLIS: All right. So it really
6 is just tied in with a particular outage schedule at
7 the plant is what is driving this.

8 MR. SCOTT: Certainly that's true, and
9 what's also driving it is the staff's view that we
10 need to encourage the utilities, even though who have
11 fall '067 outages to get these strainer installations
12 done.

13 CHAIRMAN WALLIS: In order to be fair to
14 the people who are actually doing it on time, too, so
15 that they can't say, "Well, how did those guys get
16 away with waiting and we weren't allowed to?"

17 MR. SCOTT: Well, they actually are
18 waiting longer because they're not installing their
19 strainers until spring '07 or fall '07.

20 CHAIRMAN WALLIS: In that sense they're
21 behind. Well, as long as they put these things in in
22 fall 2006, you feel comfortable allowing them to
23 delay?

24 MR. SCOTT: Well, there's more than that.
25 I mean, as Leon went over, we're looking for other

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1 features, mitigative measures, et cetera, that provide
2 us a high confidence that this plant can operate
3 safely until that spring '08 outage, but --

4 CHAIRMAN WALLIS: Just like confidence
5 relates to my saying there's little risk of it not
6 working. It's the same thing really.

7 MR. SCOTT: Without a rigorous
8 quantitative risk evaluation that's true.

9 MEMBER BONACA: Okay. Installing them
10 now, it doesn't mean that the component isn't
11 operable. It would be operable, but --

12 MR. SCOTT: I'm not sure where you're
13 going with that. Can you --

14 MEMBER BONACA: I'm trying to understand.
15 You're saying that they're asking for approval to move
16 to spring 2008.

17 MR. SCOTT: Right.

18 MEMBER BONACA: And by installing the new
19 equipment now in 2006 --

20 MR. WHITNEY: Some of the new equipment,
21 the strainers.

22 MR. SCOTT: Here's the way it works.

23 MEMBER BONACA: I'm trying to understand
24 how the equipment would work in the interim period.
25 Will it work as it was before?

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1 MR. SCOTT: Yes, let me speak to that.
2 When a plant puts in the strainer, let's say they put
3 their strainers in in fall '06. Then when they start
4 out from the fall '06 outage, they have to be operable
5 in accordance with their present licensing basis, and
6 then they have to be operable in accordance with their
7 revised licensing basis to meet the generic letter at
8 whatever the agreed date is that we provided them,
9 which will be February, March '06.

10 MEMBER BONACA: They may install it, but
11 not connect it yet.

12 MR. SCOTT: No, no, no. They're
13 installed. They're connected. I mean, there's no way
14 to install these things without removing the old ones.
15 Okay? So the new strainers are installed, and most of
16 the plants have a nonmechanistic licensing basis which
17 is that their strainer should survive 50 percent
18 blockage. Okay?

19 And I think you can imagine that's not
20 going to be difficult to show for these huge
21 strainers. So they're going to show that they're in
22 compliance with their existing licensing basis until
23 either December 31st, '07, when they need to show
24 they're in compliance with using a mechanistic basis
25 per Generic Letter 2004-02, or until early spring '08

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1 if we've agreed to that for these few plants that have
2 extension requests.

3 CHAIRMAN WALLIS: This 50 percent blockage
4 thing is going to be expunged once and for all.

5 MR. SCOTT: That's correct.

6 CHAIRMAN WALLIS: It will disappear from
7 the record.

8 MR. SCOTT: That's correct because they
9 will be replaced by a mechanistic basis, yes.

10 MR. CARUSO: So these plants don't have
11 any drawings of their sump screens in their licensing
12 basis.

13 MR. SCOTT: If they do, then they will
14 clearly have to turn in an amendment request. We
15 haven't seen one like that.

16 MR. WHITNEY: Just to correct the
17 record --

18 MR. CARUSO: That's the functional
19 definition that it has to work at 50 percent blockage.

20 MR. SCOTT: And even that's not always in
21 their licensing documents, but yes.

22 MR. WHITNEY: Some of these approved
23 extensions are into April and one, to my recollection,
24 is May to correct the record.

25 Okay. Licensee reasons for requests,

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1 design, testing and fabrication time. Many times
2 they'll be talking about their throttle valves and
3 related orifices.

4 Technical issues not resolvable by the
5 2006 outage, again, this might be related to a
6 component and they need to study design, et cetera.

7 Complexities approach. A number of
8 licensees were thinking about going with active
9 strainers, which require redundancy and power and
10 control boards and stuff, and they wanted time to work
11 on a complex approach like an active strainer, and by
12 the way, to our knowledge all licensees have decided
13 not to go with active strainers at this time.

14 Expense of installing insulation twice.
15 One licensee was going to replace their steam
16 generators in spring '08. So if in the fall they had
17 removed offending insulation, they would have had to
18 put in expensive, engineered, custom insulation and
19 then rip it out again for the new generator.

20 The circulation pump start signal change
21 turned out to be quite complex in one case.

22 Now, to answer your question about what
23 we're basing the approvals on, examples. Larger
24 strainers plus interceptors, that's typical. They may
25 not be the full, complete, final size, but they're

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1 significantly larger, an order of magnitude usually at
2 least.

3 Removal of problematic materials or
4 chemicals from containment can be a rationale for
5 approval.

6 Favorable plant characteristics, minor
7 things like curbs around the -- and slopes preventing
8 debris from getting to the strainers or something else
9 about their design, their flow paths, et cetera, that
10 may be very favorable.

11 The bulletin compensatory measures which
12 they've already placed in their plan.

13 Existing LOCA analytical margins. We
14 don't take credit for containment over pressure, for
15 example, and yet we know it's going to be there, et
16 cetera. Those kinds of arguments.

17 And reduction in LOCA frequency from NRC
18 approved leak before a break would be another
19 rationale for saying there's a low probability of an
20 event in the interim time period.

21 And if you have any questions, I'd be glad
22 to answer.

23 CHAIRMAN WALLIS: Relatively few licensees
24 are doing this.

25 MR. WHITNEY: I have three or four on my

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1 desk that are beyond the eight that have been approved
2 to be studied and adjudicated.

3 MR. SCOTT: it is conceivable that,
4 depending on how issues such as chemical effects play
5 out, we could see significantly more of these sorts of
6 things.

7 MS. REYES: A summary for this
8 presentation. NRC has received nine (unintelligible)
9 requests related to the General Letter 2004-02.
10 Additional submittals expected for plants that change
11 buffers and eight extension requests to spring 2008
12 approval.

13 MR. SCOTT: if you all have no questions,
14 we'll go straight to Mark Padovan's presentation.

15 CHAIRMAN WALLIS: We don't have questions,
16 but I think we should thank the presenters.

17 MR. SCOTT: Thank you.

18 MR. PADOVAN: Good afternoon. My name is
19 Mark Padovan. I'm the NRR project manager for
20 Palisades. Also I've asked people from our tech staff
21 who are preparing safety evaluations on Palisades, the
22 license amendment request move TSP to be here.
23 They're in the audience as well, and I'll ask them for
24 help to answer some questions that I can't.

25 The purpose of the presentation is to tell

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1 you about NMC's amendment request to remove trisodium
2 phosphate from the containment at Palisades, and then
3 to give you a status of where we are on review of that
4 LER.

5 As I understand it, there's six plants
6 that have TSP in containment, along with calcium
7 silicate. Palisades is the lead plant to remove this
8 from containment, and as far as I know, there are no
9 other applications in at this time.

10 I understand Fort Calhoun is close by, but
11 not in house as of yet.

12 In response to Information Notice 2005-26
13 and Supplement 1, NMC submitted this license amendment
14 request to revise the technical specifications to
15 remove TSP from the containment at Palisades, and this
16 would be for one operating cycle.

17 CHAIRMAN WALLIS: Are you going to put it
18 back again after one operating cycle?

19 MR. PADOVAN: No, they're having a
20 different program to use an alternate buffer at that
21 time. Removal of the TSP would be until the next
22 refueling outage in the fall of 2007.

23 Their application also included interim
24 compensatory measures using sodium hydroxide injection
25 for their post LOCA sump pH control. In our review

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1 we've sent out a number of RAIs. We've collected the
2 RAIs from various staff branches, put them in to one,
3 sent them out, got a reply, but based on that replay
4 we've got further RAI communications ongoing at this
5 time.

6 Key review considerations that we're
7 looking at are dose analysis, containment performance,
8 and chemical effects. The dose analysis evaluates
9 both the on site dose consequences and off site, with
10 the on site being the dose of the control room
11 operators.

12 Sump screen blockage and pH control,
13 hydrogen generations are items under the containment
14 performance consideration, and regarding chemical
15 effects, we're looking at things such as corrosion,
16 formation of calcium phosphate. I'll address each of
17 these in the following slides here.

18 Under dose analysis, the Accident Dose
19 Branch analyzed off site dose consequences and dose to
20 the control room personnel without TSB being available
21 in containment during the LOCA.

22 MEMBER KRESS: Now, when they do this nine
23 basis calculation of trisodium phosphate, they're
24 assuming the iodine in containment is
25 (unintelligible)?

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1 MR. PADOVAN: I will ask Michelle, but
2 it's both elemental and the other.

3 MS. HART: Right. This is Michelle Hart
4 from the NRR staff.

5 They are currently under the old TID
6 source term, and so they have kept that speciation.
7 So it's mostly elemental and organic.

8 MEMBER KRESS: Elemental.

9 MS. HART: Yeah.

10 MR. PADOVAN: And in the analysis that
11 both utility and our staff is doing, it's very, very
12 conservative. It assumes that iodine in the
13 containment sump instantaneously reevolves into
14 containment, and that the containment sprays would not
15 remove any iodine.

16 CHAIRMAN WALLIS: So if they replace this
17 trisodium phosphate with sodium hydroxide, doesn't
18 that control the pH just as well? Doesn't it have the
19 same effect on the iodine or not?

20 MS. HART: This is Michelle Hart again.
21 They did not want to take credit for sodium hydroxide
22 replacement for purposes of pH control for dose
23 analysis for the radiation reduction.

24 CHAIRMAN WALLIS: They still want to use
25 it for something else?

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1 MS. HART: Right, and it's not being
2 injected right away. It's not being injected until
3 later in the event.

4 MEMBER KRESS: The trisodium phosphate
5 enhances the spray remove of iodine. I don't think
6 the sodium hydroxide will do that. So you lose that
7 aspect of it.

8 MS. HART: Right.

9 MEMBER KRESS: But it still would remove
10 some iodine. Indeed, we put some water.

11 MR. PADOVAN: This very conservative
12 analysis done by staff and the utility showed that if
13 you remove the TSP from containment, the NRC could not
14 meet control room habitability criteria. Thus, they
15 are implementing the compensatory measures which would
16 be the introduction or use of potassium iodide control
17 with control room operators and use of self-contained
18 breathing apparatus as well.

19 Now, based on that, we have determined
20 that the utility's estimates of off site and control
21 room doses do meet our criteria with control room
22 operator use of potassium iodine.

23 Regarding containment performance review
24 considerations, we're assessing the impact of removing
25 TSP on sump screen blockage, pH control and hydrogen

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1 generations during these DBAs. I'll discuss that in
2 each of the following slides here.

3 Regarding sump screen blockage, as
4 previously mentioned, you're aware that the
5 Information Notice 2005-26 and Supplement 1 that
6 formation of the calcium phosphate precipitate is
7 created on the sump. It could create enough blockage
8 to become --

9 CHAIRMAN WALLIS: Excuse me. They're
10 doing this because this is a CalSil plant?

11 MR. PADOVAN: Correct.

12 CHAIRMAN WALLIS: It's not just the
13 concrete debris and stuff --

14 MR. PADOVAN: Correct.

15 CHAIRMAN WALLIS: -- that provides the
16 calcium.

17 MR. PADOVAN: TSP-calcium --

18 CHAIRMAN WALLIS: It is the CalSil which
19 is the problem.

20 MR. PADOVAN: Right.

21 CHAIRMAN WALLIS: Right.

22 MR. PADOVAN: And they found that this
23 phosphate precipitation is a failure mechanism for the
24 emergency core cooling system and containment spray
25 during some LOCAs. Thus, if they reduce the potential

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1 for the pump screen blockage due to this calcium
2 phosphate, then you could reduce the risk of ECCS and
3 containment spray failure during recirculation.

4 Regarding pH control and hydrogen
5 generation, they have an existing Tech Spec 355 which
6 gives the LCLs for pH control of the sump water. What
7 it says is that there are these screened TSP baskets
8 in containment and you have to have between 8,300 and
9 11,000 pounds of trisodium phosphate. If you don't,
10 then you have 72 hours to correct that situation.

11 They're proposing deleting that tech spec
12 basis on an interim basis, but as an alternate -- on
13 a temporary basis.

14 CHAIRMAN WALLIS: What material is being
15 attacked to produce this hydrogen?

16 MR. PADOVAN: Staff?

17 PARTICIPANT: Probably aluminum would be
18 one of the major contributors to hydrogen generation,
19 but also galvanized surfaces.

20 CHAIRMAN WALLIS: That actually produces
21 hydrogen also when you go to the high pH, isn't it?

22 PARTICIPANT: We saw in the ICET tests
23 with the IR pH, we did see hydrogen levels that were
24 detectable.

25 MR. PADOVAN: Now, they are proposing to

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1 delete this tech spec on an interim basis until the
2 next outage in the fall of 2005 (sic). At that time
3 they're going to institute an alternate buffer
4 program.

5 Also, NMC concluded that removing this TSP
6 from containment would have a negligible impact with
7 respect to design basis hydrogen challenges the
8 containment integrity, and we are presently reviewing
9 that pH control and hydrogen generation issues and
10 still ongoing.

11 Regarding chemical effects, we have, as I
12 mentioned earlier, some RAIs out to them right now
13 regarding the NaOH spray pH and aluminum in
14 containment.

15 Removing the TSP and delayed introduction
16 of the sodium hydroxide has potential advantages.
17 There is no immediate formation of calcium phosphate.
18 Formation of precipitates will occur when pump NPSH
19 margins are higher, and that the spray containing
20 sodium hydroxide will be at a lowered temperature,
21 thus reducing aluminum corrosion rates.

22 In summary, our evaluation is nearly
23 complete, but again, we're waiting for these RAI
24 responses. We have some preliminary conclusions about
25 removing TSP from the Palisades containment, and they

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1 are that the estimates of the off site control room
2 doses are will they meet our criteria if the control
3 room operators use potassium iodide.

4 Risk of a sump blockage following a design
5 basis accident in containment is decreased. Formation
6 of precipitates will occur when pump NPSH margins are
7 higher, and spray containing NaOH will be at a lower
8 temperature, thus reducing the aluminum corrosion
9 rate.

10 CHAIRMAN WALLIS: Well, isn't NaOH more
11 effective at corroding aluminum than the TSP? TPS
12 doesn't particularly corrode aluminum, does it?

13 PARTICIPANT: That's correct. There will
14 be higher aluminum corrosion rates, but if you go back
15 to what we learned from the ICET with the calcium
16 silicate insulation and TSP, we saw immediate
17 precipitate formation within 20 minutes of when they
18 were combined. So expectation is in this case the
19 sodium hydroxide would not be sprayed until either
20 within seven days or within 20 hours of a loss of fuel
21 integrity.

22 CHAIRMAN WALLIS: There are two bad
23 things. One is calcium silicate. The other one is
24 this aluminum oxihydroxide. So there's some trading
25 off one against -- one is phosphates. The other one

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1 is this aluminum oxihydroxide. Trading off one
2 against the other in a way.

3 PARTICIPANT: Yes. In a way you're
4 trading off precipitates, but the advantage is you're
5 getting a much more delayed introduction.

6 MR. ARCHITZEL: This is Ralph Architzel
7 from the staff.

8 A comment on the hydrogen. It's really
9 the whole hydrogen recombiner issue, and it's a non-
10 issue because it does come in for seven says. The
11 original application was just talking about addition
12 of seven days for EQ, and I forget what the other
13 issue was. It was general corrosion of the material.
14 So the hydrogen is a non-issue for this amendment.

15 MEMBER KRESS: The control room, is it
16 normally stocked AI or will that be something new?

17 MR. PADOVAN: I believe it's something new
18 for that plant.

19 Michelle, do you know?

20 MS. HART: I'm not sure. I thought that
21 they had said it was currently a program that they
22 already had.

23 MR. PADOVAN: Well, then I would defer to
24 you on that one.

25 MS. HART: But we would have to check on

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1 that to make absolutely sure.

2 MEMBER KRESS: Does that also include
3 donning gas masks, SCBA?

4 MR. PADOVAN: The self-contained breathing
5 apparatus?

6 MEMBER KRESS: Yes.

7 MR. PADOVAN: Are you familiar with that?

8 MS. HART: The only credit they took in
9 their dose analysis was for the KI.

10 MEMBER KRESS: KI?

11 MS. HART: Yes.

12 PARTICIPANT: One other consideration.
13 One of the things we observed in both the ICET tests
14 and testing at ANL. Calcium silicate itself will have
15 an effect on pH. It will raise the pH sine there are
16 sodium silicates that will dissolve into the water.
17 In this case the licensee took no credit for that
18 during their dose considerations.

19 MR. PADOVAN: Any other questions?

20 MEMBER KRESS: Does that control room dose
21 include other things besides iodine?

22 MS. HART: Yes, it does. It also includes
23 the SHINE (phonetic) doses, is included in there, as
24 well as the noble gas dose.

25 MEMBER KRESS: Noble gases and cesium?

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1 MS. HART: Right, right. Because they're
2 in the TID 14-844 source term, they have both the
3 whole body and thyroid dose reported to meet GDC-19.

4 CHAIRMAN WALLIS: Well, these preliminary
5 conclusions seem to point to the conclusion that you
6 don't have here, which is that it would be a good idea
7 to remove this.

8 MR. PADOVAN: We're still formulating that
9 opinion. We've got more information to gather. I
10 don't think we've reached that point just yet.

11 MS. HART: One of the things to note is
12 that this particular plant had a lot of margin to the
13 dose analysis limit in the control room. So some
14 other plants may not be able to counteract the
15 increased of dose in the control room by using KI.

16 MR. ARCHITZEL: Yes, Architzel. I'd like
17 to make a comment on that good to do thing or not to
18 do thing.

19 I guess that was one of the RAIs we did
20 ask. It wasn't crystal clear that this was a risk
21 positive thing to do. So we did ask questions, and
22 that's one of the reasons we've got a double situation
23 with adding the buffer. So there is a 20 hour time
24 frame to add the buffer, which makes it more easy to
25 make that conclusion it's the right thing to do.

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1 CHAIRMAN WALLIS: So what it does is it
2 reduces the risk of failure of long term cooling, but
3 it increases the consequences of the curve; is that
4 right? You've now got more dose consequence?

5 MS. HART: If the design basis accident
6 would occur, yes.

7 CHAIRMAN WALLIS: You can't evaluate just
8 on the basis of frequency of the event. You've got to
9 also look at what you've done to the consequences.

10 MS. HART: Right, yes.

11 MR. PADOVAN: Anything else?

12 CHAIRMAN WALLIS: Okay.

13 MR. PADOVAN: Thank you.

14 CHAIRMAN WALLIS: Thank you.

15 Mike, do you want to make a concluding
16 statement?

17 MR. SCOTT: Well, I did want to mention
18 one thing, and I'll probably get in trouble with Bob
19 Dennig for this, but we talked about water management.
20 I don't know to what extent you all are aware of this,
21 but the staff is working with NEI and the industry to
22 encourage water management initiatives, and I would
23 suggest that that might be something the committee
24 might want to weigh in when it's a little further
25 along.

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1 We're actually talking to two utilities to
2 potentially be pilot plants for pursuing water
3 management initiatives. So it's pretty early in the
4 process, but I think there might well be a stage where
5 you all might want to get involved.

6 And I say Bob Dennig because he's the lead
7 for that with the staff.

8 CHAIRMAN WALLIS: What you mean by water
9 management, I think, is if you have water, you want to
10 conserve it to cool the core if you possibly can
11 rather than using it to do other things which might
12 not be necessary. Is that water management mostly?

13 MR. SCOTT: I'd state it slightly
14 differently. It is taking actions to management the
15 inventory of water you have in the RWST.

16 CHAIRMAN WALLIS: The clean water that you
17 have.

18 MR. SCOTT: Right. To minimize the amount
19 of times you demand from the sump.

20 CHAIRMAN WALLIS: Right, but in principle
21 if you could you'd like to conserve it to cool the
22 core.

23 MR. SCOTT: Right. So you're talking
24 about changes might be to containment spray.

25 CHAIRMAN WALLIS: You do need water to

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1 cool the core.

2 MR. SCOTT: Right.

3 CHAIRMAN WALLIS: There's a minimum
4 requirement there.

5 MR. SCOTT: Right. So that's something
6 you all might want to think about.

7 CHAIRMAN WALLIS: Well, most of this we
8 probably don't have much to say. We're being informed
9 about this. It's interesting. A lot of it is in
10 regulatory space. We don't go too much into
11 regulatory space.

12 MR. SCOTT: Right. There are some
13 technical issues here related to water management and
14 some other odds and ends.

15 The pH buffer, of course, is a big
16 consideration. As you saw, the staff is looking at
17 that for a couple of these, and we may see more like
18 it or similar to it.

19 CHAIRMAN WALLIS: So when do we meet with
20 you again and what are we going to hear? When is the
21 next step where something substantial has happened
22 that we ought to hear about it?

23 MR. SCOTT: Tom, step up here and remind
24 me what the schedule said.

25 MR. HAFERA: Well, Ralph and I just talked

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1 about that yesterday. We were originally proposing an
2 update for you in November on our audit activities.
3 However, from what I understand, you as a committee
4 are very busy with some other higher priority items.

5 CHAIRMAN WALLIS: Some of your colleagues
6 have started to snow us with some other requests.

7 MR. HAFERA: And we're graciously willing
8 to postpone --

9 (Laughter.)

10 MR. HAFERA: -- to defer to our colleagues
11 and give them the more valuable time.

12 CHAIRMAN WALLIS: Is that the way it
13 worked or did you somehow get in league with them?

14 (Laughter.)

15 MR. HAFERA: No. To be perfectly honest,
16 I was asked. We were requested. The ACRS has some
17 other very high priority items and --

18 CHAIRMAN WALLIS: Well, we were told by
19 the Commission to make this sump blockage question a
20 major priority. They don't usually tell us to
21 prioritize something, and they did ask us to
22 prioritize this one. So I think if you had something
23 substantial to bring to us, we would make space for
24 it.

25 MR. SCOTT: Well, let me tell you where

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1 we're going to be if the subject is the audits. We
2 are right in the process of doing Audit No. 2. We did
3 an audit of Watts Bar that we're just about ready to
4 finalize the report on, and we are in the middle of
5 auditing San Onofre.

6 CHAIRMAN WALLIS: Watts Bar is interesting
7 because I think they are taking credit for settling
8 out of some of the debris before it gets to the
9 strainer.

10 MR. SCOTT: No, no. Watts Bar is pretty
11 much --

12 CHAIRMAN WALLIS: That's what they told us
13 or maybe you told us the last time you presented to
14 us.

15 MR. SCOTT: Well, one thing about Watts
16 Bar is they don't have much debris.

17 PARTICIPANT: They don't have any fiber.

18 DR. LU: It's an RMI plant, and they
19 assume 100 percent of transport role of the RA coating
20 debris. So they took the credit from the CS-3D CFD
21 calculation for the RMI.

22 CHAIRMAN WALLIS: Take credit?

23 DR. LU: Yes, they did. They did take
24 credit, but not too much, but ten percent or 15
25 percent. I cannot remember the exact number. So we

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1 are pretty much done with Watts Bar. That's what Mike
2 says.

3 CHAIRMAN WALLIS: Watts Bar is actually
4 assuming a large amount of paint comes loose.

5 DR. LU: That's right. The entire
6 containment.

7 CHAIRMAN WALLIS: Right.

8 MR. SCOTT: But even so, they are a low
9 susceptibility plant.

10 So we're finishing that one up. We're in
11 the middle of San Onofre. We're planning to visit
12 Prairie Island in the fall. So were we to come back
13 to you in the November-December time frame, we'd have
14 some information on those three audits. A lot of it
15 would still be preliminary. You might actually
16 benefit more. We might actually benefit more from an
17 interaction in -- let's see. You all don't usually
18 meet in January, if I recall correctly -- maybe in the
19 February time frame on that?

20 CHAIRMAN WALLIS: Like that, sure. Okay.

21 MEMBER KRESS: Thank you.

22 CHAIRMAN WALLIS: Anything else we need to
23 do today?

24 MEMBER MAYNARD: I've just got a couple of
25 comments.

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1 CHAIRMAN WALLIS: Yes, please.

2 MEMBER MAYNARD: First of all, I found the
3 presentations all very informational and I really
4 appreciate it. I think everybody did a good job.

5 One thing that I didn't see that I think
6 perhaps needs to be address in some of this testing,
7 and that's temperature effect on some of the debris.
8 Is there a point someplace below boiling but above 100
9 degrees where some of these tests were being done
10 where some of the debris may have a significant change
11 in its characteristic?

12 And what I'm thinking of is maybe a paint
13 chip or something like that. Is there some point
14 where it significantly softens or whatever?

15 I doubt that there is, but I just didn't
16 see any explanation that said it doesn't significantly
17 change characteristics.

18 MEMBER KRESS: It looked like that would
19 be an easy thing to look at.

20 MEMBER MAYNARD: Yes.

21 MEMBER KRESS: You wouldn't have to do a
22 blockage. You could just look at what happens to the
23 paint chips after they got hot.

24 CHAIRMAN WALLIS: but you might want to
25 also see if there's any effect on the strainer.

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1 MEMBER KRESS: Yes, if there was any
2 effect on it.

3 CHAIRMAN WALLIS: Suppose the paint chip
4 does get softer. Does it make any difference?

5 MEMBER KRESS: Then you run a blockage
6 test.

7 MR. HAFERA: Excuse me. Tom Hafera again
8 from staff.

9 If you recall when we presented some
10 research that was done, Irv Geiger is not in the room
11 right now, but we did do some testing on paint chips
12 with Carderock, and they did heat the chips up to 140
13 degrees at that time.

14 CHAIRMAN WALLIS: They were all pretty
15 stiff.

16 MR. HAFERA: Yes, yes.

17 CHAIRMAN WALLIS: They didn't soften.

18 MR. HAFERA: Yes. If you recall, they
19 said that they created curled chips, right? And they
20 heated them up, and as they heated, they softened and
21 flattened out and sank. So there was a tendency for
22 the curled chips to actually flatten and sink at
23 around 140 degrees.

24 MEMBER MAYNARD: And I just think that
25 from what I heard that either the staff or the

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1 licensee, somebody needs to address it. It sounds
2 like you may have the information for that, but it
3 still --

4 CHAIRMAN WALLIS: Well, a flat chip if it
5 landed across some poles on a string, it would be more
6 effective at blocking it than a curling chip.

7 MR. HAFERA: Yes, but again, what they
8 found was then they sink and sit on the floor and
9 don't transport.

10 MEMBER MAYNARD: One other general comment
11 I have. It looked like in my opinion NRC may be
12 forcing more conservatism than necessary on the
13 transport, trying to get everything out. It looks
14 like all of these test facilities had to do a lot of
15 work to get the debris suspended into the screen, and
16 my concern is that we may end up with overly
17 conservative, much larger screens than what's really
18 needed and may have some other consequences,
19 additional dose in containment doing work. It's going
20 to be harder to do work.

21 There's a number of other things that
22 could factor into this if we make these screens
23 significantly larger than what they need to be. So
24 just kind of as a general comment there.

25 But I did enjoy the presentations. It

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1 looks like a lot of good work is going on.

2 MR. SCOTT: If I can interject one thing
3 on that, one point to consider is that the chemical
4 effects which are as yet unresolved may drive them
5 larger. We may be glad at the end of the day we had
6 that extra space. It's not predictable at this point.

7 MEMBER MAYNARD: I understand.

8 CHAIRMAN WALLIS: Well, what we missed
9 today and yesterday was the utility's point of view,
10 and we heard from the people who are selling
11 strainers, and they seem to be interested in
12 understanding what's happening. The utility is
13 interested in what's good for the plant. That gets a
14 bit to your topic here, and what's optimum for the
15 plant may be somewhat different than what the vendor
16 of the strainer thinks is appropriate.

17 Is there any prospect of hearing from the
18 utilities some time down the road?

19 MR. SCOTT: Well, you did hear from the
20 owners group a little bit today. You heard from Mo,
21 right?

22 CHAIRMAN WALLIS: But you have to hear
23 something really specific. I think you have to have
24 sort of a case history of what happened to the
25 particular place, why they chose certain strainers,

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1 how they made the decisions and so on. That really is
2 quite a technical thing.

3 MR. BUTLER: Dr. Wallis, I of course
4 cannot volunteer someone, but if there is a strong
5 interest in hearing a licensee perspective maybe at
6 the appropriate point in their design plan --

7 CHAIRMAN WALLIS: Maybe we should.

8 MR. BUTLER: -- I think we could probably
9 find or force a volunteer.

10 (Laughter.)

11 CHAIRMAN WALLIS: Is there any interest in
12 the committee in hearing from licensees?

13 MEMBER KRESS: Yes, I think that would be
14 great.

15 CHAIRMAN WALLIS: Maybe we should think
16 about that, Ralph, next time, which will perhaps be
17 next year.

18 MR. DINGLER: Do you want to look at the
19 January-February time frame? That gives us time.

20 CHAIRMAN WALLIS: It's much easier to
21 travel. No thunderstorms.

22 MR. DINGLER: No snow on the ground and
23 stuff like that.

24 CHAIRMAN WALLIS: Okay. Anything else?

25 I agree with you. The presentations were

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1 well prepared and presenters were very responsive to
2 questions and so on. What was, as we said, lacking
3 was data, but the overall impression was a good one,
4 I think.

5 Okay. It's nice to finish on the hour.
6 I'd like to finish at three o'clock. Are we ready to
7 do that?

8 The words are adjourned. I adjourn the
9 meeting. Thank you all very much.

10 (Whereupon, at 3:00 p.m., the meeting was
11 adjourned.)

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