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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

THERMAL-HYDRAULIC PHENOMENA SUBCOMMITTEE MEETING

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WEDNESDAY,

MAY 16, 2007

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The meeting was convened in Room O1G16, 11555 Rockville Pike, Rockville, MD, at 8:30 a.m., Graham B. Wallis, Chair, presiding.

ACRS MEMBERS PRESENT:

GRAHAM B. WALLIS	Chair
SANJOY BANERJEE	Vice Chair
SAID ABDEL-KHALIK	Member
THOMAS S. KRESS	Member

STAFF PRESENT:

ZENA ABDULLAHI	Designated Federal Official
RALPH ARCHITZEL	NRR
JOHN BUTLER	Nuclear Energy Institute
PAUL KLEIN	NRR
JOHN LEHNING	NRR
SHANLAI LU	NRR
MICHAEL SCOTT	NRR
STEVEN UNIKEWICZ	NRR
LEON WHITNEY	NRR

ALSO PRESENT:

TIM ANDREYCHEK	Westinghouse Electric Co., LLC
JAY BASKIN	Enercon
VALERIE CAMBIGIANIS	Entergy
ROB CHOROMOKUS	Alion
MAURICE DINGLER	WCNOC
RICHARD DRAKE	Entergy
JOE GASPER	Omaha Public Power District
ADI IRANI	Entergy
CHRIS KUDLA	PCI
ERIC LARSON	General Electric
NICK RAMSAUR	General Electric
AARON SMITH	Enercon

A-G-E-N-D-A

PLANT RESOLUTION OVERVIEW

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

8:33 a.m.

CHAIRMAN WALLIS: Good morning. I think we're all ready to get started.

This is the second day of a meeting of the Thermal-Hydraulics Subcommittee of the ACRS.

We're going to hear from three plants about what they're doing with their sumps. And the first one up this morning is Fort Calhoun.

Please go ahead. We'll try to keep on time today because people have to leave at the end of the day.

MR. GASPER: Yes. We wouldn't want to miss our plane flights.

I'm Joe Gasper. I'm Manager of Major Projects out at Fort Calhoun Station. And one of my projects, the one that consumes almost all of my time, is resolution of GSI-191. And so I'm here this morning to speak on our proposed path to resolution.

With me this morning is Eric Larson and Nick Ramsaur from General Electric on my left. And General Electric is the vendor supplying our strainer and has been responsible for the testing.

And Rob Choromokus from Alion is on my right here. Alion did all the debris generation transport calculations, et cetera.

We had one other vendor involved, Sargent Lundy did our downstream analysis. I'll go briefly into that, but you heard quite a bit yesterday on downstream and we're in the same situation as everybody else. We did it based on Rev. O and now we'll have to redo it based on when the SER is out on that.

Currently Fort Calhoun has received an extension to the completion of our '08 refueling outage, which is scheduled for April and May of 2008. And I'll go into details on what we did install during our 2006 outage and we've done to date.

So in going through if I wanted an agenda, basically what I was planning to do is somewhat historically walk through the process that we've gone through; where we initially started, the situation with the station, interim measures we put in, the number of modifications we put in during our 2006 outage, testing that we have done to date, our approach to chemical effects. Go through the decision tree that led us to implement the water management strategy, and I'll go through the plans for that. And then finally what we have planned for our 2007 strainer testing.

Next slide, please.

The horizontal cross section of the Calhoun containment. I'll be referring to the alpha and bravo sides throughout the presentation.

This is a typical combustion engineering two steam generator for cold leg, two hot leg plant. It's compartmentalized containment. And it's rated at 1500 megawatts thermal.

Just a quick look at the vertical cross section again. All the compartments are open to the upper portion of the containment. And you'll notice that the vessel itself is actually below the level of the sumps. The bottom of the vessel sits below the bottom of the containment floor. The sumps are located on the elevation 994 level of the plant. It's a flat floor and the sumps sit up on the floor itself.

The next slide is simply to show the flow paths. From the alpha side we have a fairly long path over to the inlet to the sump.

CHAIRMAN WALLIS: This is a plant with very big cold legs, is it, if I remember.

MR. GASPER: Yes.

CHAIRMAN WALLIS: They're very big.

Okay.

MR. GASPER: Yes, 32 inch.

CHAIRMAN WALLIS: Thirty-two inch?

MR. GASPER: Yes.

CHAIRMAN WALLIS: Okay.

MR. GASPER: Well, two hot leg, four cold leg.

CHAIRMAN WALLIS: Oh, four? Four cold leg.

How big are the hot legs then?

MR. GASPER: I think it's 32 on the hot legs and 28 on the cold legs.

MEMBER WALLIS: So it's only 32?

MR. GASPER: Yes.

CHAIRMAN WALLIS: Well, it might be bigger than that.

MR. GASPER: Honestly, I'd have to go back and get you the exact number.

CHAIRMAN WALLIS: Okay. That's all right.

MR. GASPER: There are four reactor coolant pumps that take suction off the steam generators and then feed back to the vessel through the two hot legs. And it's a standard layout for a combustion engineering design.

CHAIRMAN WALLIS: Okay.

MR. GASPER: As I said, there's a relatively long flow path from the alpha bay into the sumps. And then there's short path from the bravo bay into the sumps.

CHAIRMAN WALLIS: Well those sumps must be the present ones?

MR. GASPER: That's actually just basically the inlets to the sumps. Well, they're the old sumps.

CHAIRMAN WALLIS: Yes.

MR. GASPER: And throughout here we did not model necessarily the sumps, and I'll explain. We just modeled basically the inlet to the piping. And the methodology we used to calculate debris transport it turns out to be a conservative method to do that.

The emergency core coolant system at Calhoun consists of two fully redundant recirculation paths with two sumps. And there's three containment spray pumps, two low pressure safety injection pumps and three high pressure safety injection pumps.

Originally, and I'll discuss modifications, all those pumps received out of start signals on a LOCA event. There's four safety injection tanks, et cetera, that also inject into the reactor vessel.

CHAIRMAN WALLIS: So these pumps are below the level here, presumably, are they?

MR. GASPER: Yes.

CHAIRMAN WALLIS: They are? Okay.

MR. GASPER: The pumps are housed in a lower level room of the plant, outside the plant. And the lines go in fairly typically.

The original on the next slide were just a simple round cylinder sump. They had 56 square feet of surface area. They were composed of a quarter inch mesh material. So our original layout just had those two sumps in it.

VICE CHAIRMAN BANERJEE: How high were they?

MR. GASPER: Those are roughly 3½ feet. They were near the top of the fill level of the containment. They had vortex preventers in the pipe that's down below them. And I believe that line you see along the side of containment is basically the nominal fill line that you'd get to if you refilled containment. It's very close to that. I don't know if it is exactly there, but it is very close to the fill level.

CHAIRMAN WALLIS: Yes. These are the garbage can size?

MR. GASPER: These are the garbage can size, yes.

CHAIRMAN WALLIS: Right.

MR. GASPER: They were built based on the original design criteria, which were redone at train.

CHAIRMAN WALLIS: The original design criteria was that you have a 50 percent block no matter how big they were.

MR. GASPER: That's right. Fifty percent blocked redundant trains was the original design criteria.

CHAIRMAN WALLIS: Yes.

MR. GASPER: We used trisodium phosphate as our buffer. It was housed in five baskets that are located around the containment. And you can see the location of those buffers on slide 8.

VICE CHAIRMAN BANERJEE: What elevations were they at?

MR. GASPER: The bottoms of them are approximately 12 inches off the floor. So they're fully submerged on refill.

CHAIRMAN WALLIS: And the way they work is that the chemical slowly dissolve and --

MR. GASPER: Yes. The chemical slowly dissolve and diffuse into the water as you go through the rebill.

CHAIRMAN WALLIS: So the diffusing upstream would be rather difficult if the flow is coming around from the right hand compartment?

MR. GASPER: Yes.

CHAIRMAN WALLIS: All the way around the containment to the sump, it's going to sweep --

MR. GASPER: It's going to sweep the--

CHAIRMAN WALLIS: -- the buffer around where the buffer, presumably, doesn't flow up stream very well.

MR. GASPER: Right. But it'll --

CHAIRMAN WALLIS: So a quarter of the containment is going to be unbuffered, presumably?

MR. GASPER: Well, it's basically once through circulation --

CHAIRMAN WALLIS: And then it comes around again?

MR. GASPER: Yes.

CHAIRMAN WALLIS: It comes around again.

MR. GASPER: Yes.

CHAIRMAN WALLIS: Once circulation starts.

MR. GASPER: There's a criteria in one of the guidance documents --

CHAIRMAN WALLIS: Right.

MR. GASPER: -- as to how many recirculations you have to have the fully diffused to achieve at the age of seven, which we meet. I just don't remember that criteria right now.

You know, some of the key points from the original design was that it's a large dry containment, two independent recirculation paths, three containment spray and three HPSI pumps. Like I said, we had 28 square feet per strainer and five TSP baskets. And the strainers and the buffers sit on a flat containment floor at the bottom of the containment.

VICE CHAIRMAN BANERJEE: And the containment spray is fairly uniform or --

MR. GASPER: Yes. The containment spray is in six concentric rings spray header at the top of containment, three on each one of the spray loops.

VICE CHAIRMAN BANERJEE: Fairly uniform?

MR. GASPER: Fairly uniform. The

nozzle, the droplet size I don't remember, but they're designed for a fine mist type spray.

VICE CHAIRMAN BANERJEE: How long are they on for?

MR. GASPER: Nominally right now with all pumps operating it's about 20 minutes. It takes about 20/25 minutes to empty the refueling water tank before you go on recirculation. And that's during the blowdown, and then they stay on, I believe a minimum of five hours for the iodine control is current design.

We did an extensive assessment of our containment insulation and coatings during a fall 2003 refueling outage. The results of that walkdown are shown on the following slide.

You can see that we dominately have a calcium silicate insulation. Most of that contained asbestos. And you can see the various other insulations.

The stainless steel RMI was on the reactor vessel.

The steam generator's pressurizer were insulated with calcium silicate.

You can see are qualified coatings. And the latent debris was based on a similar process that was used that Salem described yesterday. We did do some characterization of that latent debris to determine --

VICE CHAIRMAN BANERJEE: You have less latent debris, right?

MR. GASPER: What?

VICE CHAIRMAN BANERJEE: You seem to have less latent debris.

MR. GASPER: Yes. And as I get through, we'll --we've even got considerably less now than 159 pounds. It's also a smaller containment, that's true, too. Less surface areas.

And we had arbitrarily included in our analysis among equipment labels 71 square feet for the type of labels we have that could blow off during it.

Just a quick picture of our old steam generator. It was, as I say, Cal-Sil insulation with basically aluminum flashing on the outside of it.

As interim measures we did look at a couple of changes that we could make. One of our EOP strategies was to refill the refueling water storage tank. In addition, we received approval for leaving only one train of containment spray running. All three of the pumps automatically start on the amount of recirculation. That considerably lengthened out the time before we went on recirculation.

And the other thing that's further unique to Fort Calhoun is that we can externally flood the reactor vessel.

The next slide shows that there is a flow path through the -- basically it gets us under the reactor vessel. We have done the analysis to basically reflood the top of the hot legs by refueling the SWIRT. We've done the analyses to determine what instrumentation is missing and that structurally the containment can handle that water load. So that strategy is embedded in our EOPs and will stay there in the future. So that is one of the more unique features of the plant is we have that ability.

CHAIRMAN WALLIS: So you flow up inside the walls surrounding the vessel, is that what you do?

MR. GASPER: Yes. Well, and then you actually fill up above the containment floor. You just keep filling.

CHAIRMAN WALLIS: Keep filling the whole containment?

MR. GASPER: You basically fill the whole containment up to that. So --

MEMBER KRESS: What's your power level thermal?

MR. GASPER: 1500 megawatts.

MEMBER KRESS: That's thermal?

MR. GASPER: Thermal, yes.

MEMBER KRESS: So that's low enough that they might be successful with this external cooling?

MR. GASPER: Yes. We have done some analyses as part of our SAMG work to determine the X vessel cooling was a -- as long as you keep water inside the vessel, X vessel cooling is a means that you can use for --

CHAIRMAN WALLIS: You mean the heat is transferred through the vessel?

MR. GASPER: Vessel wall -- well, and it's also in this case as we continue through safety injection you would be transferring heat out through the core directly out through the break and into the containment. So you'd be basically just heating up the cool water as you refilled the refueling water storage tank with.

VICE CHAIRMAN BANERJEE: So the water level in containment would be above the hot and cold leg?

MR. GASPER: Yes, we took it above the hot leg so we could -- yes. Cold legs are actually slightly lower than the hot leg. So, yes.

And we did the analysis. And this was just the -- and I say "just." This was an analysis we were able to do to take -- you know, it's a unique design feature. It's beyond design basis, but it does provide you another success path in keeping you from getting to a core melt scenario. And it's an option of the existing sumps.

We completed a major refueling outage last fall. During that outage we replaced --

VICE CHAIRMAN BANERJEE: Okay. But where is your pressurizer?

MR. GASPER: The pressurizer is -- we'd have to go clear back to that circumferential slide. It's off to the -- let me reorient myself. It's off to the side of the alpha steam generator bay inside those biological shields. It's sitting in there.

CHAIRMAN WALLIS: You can't see it.

VICE CHAIRMAN BANERJEE: You can't see in that slide?

MR. GASPER: You can't really see it, no.

VICE CHAIRMAN BANERJEE: Is it behind one of the steam generators?

MR. GASPER: Yes, basically. It sits in behind one of the steam generators.

During our 2006 refueling outage we replaced both steam generators, the pressurizers and the reactor vessel head. In that process we removed the 975 cubic feet of Cal-Sil. We removed a lot of the high density fiberglass. We replaced that with RMI and low density fiberglass.

And in addition we removed about 7100 square feet of unqualified coatings so that it took a number of actions to considerably reduce our debris loads.

CHAIRMAN WALLIS: That's what? Sixty percent of the Cal-Sil?

MR. GASPER: Yes, roughly 60 percent of the Cal-Sil. There remains some Cal-Sil on the hot and cold legs where they go through the biological shields and one reactor coolant pump is still insulated with Cal-Sil.

VICE CHAIRMAN BANERJEE: One what?

MR. GASPER: One reactor coolant pump.

VICE CHAIRMAN BANERJEE: Is it just accessibility why you didn't replace it all?

MR. GASPER: Well, those combined with asbestos. We'd have to --

VICE CHAIRMAN BANERJEE: Right, right.

MR. GASPER: When you put those two together it gets to be an extremely expensive operation to remove the insulation. We basically had to tent those entire bays to get the steam generators out.

CHAIRMAN WALLIS: How do you remove this unqualified coating? That's just unqualified coating is on electrical fittings and things, isn't it?

MR. GASPER: This coating was on the steam generators --

CHAIRMAN WALLIS: Oh, it was on the steam generators?

MR. GASPER: -- and the pressurizer. When they shipped those vessels originally they had aluminum paint on that.

CHAIRMAN WALLIS: Okay. So that's what you took off.

MR. GASPER: So the new vessels, obviously, had no coatings on them.

CHAIRMAN WALLIS: Okay. So the coating went out with the steam generators?

MR. GASPER: Yes. The coating went out with the steam generators. So it did allow us to get rid of a pretty fair -- large amount of unqualified coatings?

VICE CHAIRMAN BANERJEE: How old is the plant?

MR. GASPER: The plant went in operation in 1973. And I believe we were commercial in '74.

We installed two 525 square foot GE strainers. They use a 16th inch perforated plate. Because we had Cal-Sil and the potential with TSP for the formation of the block, we changed out the buffer from TSP to sodium tetraborate.

In addition, we removed the autostart feature from one containment spray pump to one high pressure safety injection pump which reduces the amount of recirculation and also extends the injection phase of an accident.

We installed a number of devices that minimize holdup on the floors above the strainer level --

CHAIRMAN WALLIS: Excuse me. I should ask you about the strainers. It says two 525 square feet strainers?

MR. GASPER: Yes.

CHAIRMAN WALLIS: The audit I read said something about 2800 square feet of strainers. What's the difference here?

MR. GASPER: We were able to get two -- the two 525s are not intended to resolve the GSI completely.

CHAIRMAN WALLIS: So you're going to put some more in?

MR. GASPER: We may. I'll go through--

CHAIRMAN WALLIS: Oh, I see.

MR. GASPER: We're going through some different strategy changes right now.

CHAIRMAN WALLIS: Okay.

MR. GASPER: Yes, these were an interim installation.

CHAIRMAN WALLIS: Okay.

MR. GASPER: And we, obviously, increased by about a factor of 25, some were between 20 and 25 the square foot on each one of those strainers by doing that installation.

CHAIRMAN WALLIS: Is this one unit that we see in figure 15?

MR. GASPER: Yes. There's one unit installed on 15. The second unit is shown on--

CHAIRMAN WALLIS: It doesn't look very

much bigger than the previous strainers.

MR. GASPER: Well, they're about 3 by 4 by 8 feet.

CHAIRMAN WALLIS: Yes. But they get a lot of area because of the stacked disks, is that what it is?

MR. GASPER: Yes, the stacked disks provide --

CHAIRMAN WALLIS: But the superficial area is not all that much bigger than before? The size of the box isn't all that much bigger than the garbage can, is it?

MR. GASPER: Well, they're quite a bit bigger.

CHAIRMAN WALLIS: Maybe twice as big or something?

MR. GASPER: Four or five times as big.

CHAIRMAN WALLIS: Oh, okay.

MR. GASPER: Yes. The square footage is considerably --

VICE CHAIRMAN BANERJEE: So the volume of these is about four or five times the original volume?

MR. GASPER: No. The original one was about 25 and we went to about --

VICE CHAIRMAN BANERJEE: But I'm not talking about the area. I'm talking about the volume.

PARTICIPANT: The footprint?

MR. GASPER: The footprint?

VICE CHAIRMAN BANERJEE: Yes.

MR. GASPER: Five, six --

VICE CHAIRMAN BANERJEE: You say that was about, I've forgotten, 3½ feet or something?

CHAIRMAN WALLIS: Yes.

MR. GASPER: Well, they're both about the same height.

VICE CHAIRMAN BANERJEE: Yes.

CHAIRMAN WALLIS: Yes, they're both about the same height, and --

VICE CHAIRMAN BANERJEE: This is a bit bigger?

CHAIRMAN WALLIS: It's longer. It's longer.

MR. GASPER: That one was about 18/20 inches in diameter. This is roughly 8 feet long by 4 feet wide.

VICE CHAIRMAN BANERJEE: But that's doesn't look like that long and skinny. It looks --

MR. GASPER: It sits on an 18 inch pipe.

The think the flange itself was a 20 or 24 inch flange.

VICE CHAIRMAN BANERJEE: So the diameter of that 3½ foot device was only --

MR. GASPER: It was about --

VICE CHAIRMAN BANERJEE: It looks bigger than that.

CHAIRMAN WALLIS: Three feet or something.

VICE CHAIRMAN BANERJEE: It looks like three foot.

MR. GASPER: No. It's more like --

VICE CHAIRMAN BANERJEE: It looks like a right cylinder, roughly. Well, maybe it's a little less, but --

MR. GASPER: It was about 3 feet high and about 20 inches, if I remember correctly, in diameter. I believe that's a 20 inch circle, or so, that it sits on. A 24 inch circle that it sits on.

VICE CHAIRMAN BANERJEE: Anyway.

MR. GASPER: Anyway.

VICE CHAIRMAN BANERJEE: But these are stacked disks?

MR. GASPER: Yes. These are stacked disks.

VICE CHAIRMAN BANERJEE: And you're going to tell us all about the gap spacing and everything, right?

MR. GASPER: I wasn't going to go into detail. Eric can cover those if you want.

CHAIRMAN WALLIS: The picture on page 17, I think what we're looking at is a set of disks. These things along --

MR. GASPER: Yes.

CHAIRMAN WALLIS: Each one's an individual disk?

MR. GASPER: Yes.

VICE CHAIRMAN BANERJEE: Or plates.

CHAIRMAN WALLIS: Or plats.

MR. GASPER: Plate. Each one of them is a plate.

CHAIRMAN WALLIS: Rectangular disks.

VICE CHAIRMAN BANERJEE: This is like what GE sticks into their PWRs, right? I mean but you use disks, similar things? With you got side entry as well as front entry? So these disks are perforated on the sides or these plates as well as on the --

MR. LARSON: On the right. Is that what you're trying to say, it's all the way around and--

VICE CHAIRMAN BANERJEE: And the faces. The faces are perforated as well as the ring, right?

MR. LARSON: Right.

MR. GASPER: No. Just the faces are perforated.

VICE CHAIRMAN BANERJEE: Oh. Because here the diagram seems to show their -- but anyway, you show us a picture of one of these sometime. Please.

CHAIRMAN WALLIS: So each strainer could handle about a pickup load of stuff if it were full? If it were jam packed full of debris?

VICE CHAIRMAN BANERJEE: Well, it's the same thing as Vermont Yankee except -- the same sort of--

CHAIRMAN WALLIS: Disks. Disks.

VICE CHAIRMAN BANERJEE: Disks. They've had disks, right.

MR. GASPER: Yes. Each strainer would also fit in back of the pickup region as well.

CHAIRMAN WALLIS: Yes. Yes, it would.

MR. GASPER: And that would be about the extent. That would pretty well fill up the back of a pickup.

CHAIRMAN WALLIS: Right. Four by 8 is a

standard footprint in the back of a pickup.

VICE CHAIRMAN BANERJEE: How many pickup loads of debris do you have?

MR. GASPER: Well, we'll get to that in the next -- I could convert that and do a volumetric here --

VICE CHAIRMAN BANERJEE: This is going to be our new unit.

MR. GASPER: Yes, I know. I'm going to have to do quick conversion here.

Just a quick, we did replace all the --

CHAIRMAN WALLIS: Two cubic meters?

MR. GASPER: Something.

CHAIRMAN WALLIS: Two cubic meters.

MR. GASPER: Two cubic meters. I'll have to do another conversion here.

We did replace all that Cal-Sil insulation with RMI where we could and then, as I said, that considerably reduced our debris load. And this is just a picture of the RMI on top of the steam generators.

VICE CHAIRMAN BANERJEE: So just to show us these strainers a little more, those pipes, gigantic pipe coming out and so on, is that going into the sump there?

MR. GASPER: Yes. Well, no. That's actually just on the pipe. There is no below floor sump. That's simply the pipe that now goes to the--

CHAIRMAN WALLIS: Goes to the pump directly?

MR. GASPER: Into the pumps directly.

VICE CHAIRMAN BANERJEE: Oh. So there's no below floor sump?

MR. GASPER: There is no below floor sump.

VICE CHAIRMAN BANERJEE: So the vertical pipe there is --

MR. GASPER: The vertical pipe there is for the penetration testing and inspection. It's inspection and penetration test.

VICE CHAIRMAN BANERJEE: So the pump is where now?

MR. GASPER: The pump is in a separate room in the auxiliary building that services containment.

VICE CHAIRMAN BANERJEE: The pipe goes down--

MR. GASPER: The pipe goes down and under and into a separate room.

VICE CHAIRMAN BANERJEE: It bends and so

on?

MR. GASPER: Yes. There's a path that it takes to get down there.

VICE CHAIRMAN BANERJEE: How big is that pipe?

MR. GASPER: I think an 18.

MR. RAMSAUR: The pipe is 17.

MR. GASPER: Yes, it's an 18.

Did you have a question on the strainers?

CHAIRMAN WALLIS: No. Those pipes are where the old strainers used to be?

MR. GASPER: Yes. You can see the wider flange on the flange on the bottom on the floor there. That's exactly comparable to the flange that you could see on the previous ones. We've bolted it basically down to that flange on the floor.

VICE CHAIRMAN BANERJEE: So all the piping going through the pumps remains the same?

MR. GASPER: That's correct.

MEMBER ABDEL-KHALIK: Now, this reactor vessel flooding system you said you can get water up to the level of the hot leg?

MR. GASPER: Yes.

MEMBER ABDEL-KHALIK: What is the

elevation difference between the hot leg and the top of this strainer?

MR. GASPER: I'm thinking on the order of 12 feet.

MEMBER ABDEL-KHALIK: Twelve feet?

MR. GASPER: Yes.

MEMBER ABDEL-KHALIK: And when do the EOPs instruct the operator to start this reactor vessel flooding?

MR. GASPER: If you basically could know -- if you lost recirculation, it was a method. If your sump was plugged such that you lost recirculation, the ability to recirculate, then--

MEMBER ABDEL-KHALIK: Then you use the plug?

MR. GASPER: The process is once you empty to the refueling water tank, the EOPs instruct you to start refilling it. And then if you would lose recirculation, then to start injecting again. Oil uprate is on the order of 120 gpm or so.

MEMBER ABDEL-KHALIK: Okay. Thank you.

MR. GASPER: So you basically would reject at -- the EOPs contain curves that show you to inject above the oil uprate as a function of time.

Going to slide 19. In 2005 we undertook a hydraulic testing program for the strainers. And as part of this work we were one of the pilots for the NRC audit. I'm sure you've seen the report. And we conducted testing and sizing of a strainer arrangement at that time. AT that time it was strictly for retesting only. We did use the post-2006 refueling outage to reloads, and at that time we used one containment spray and HPSI pump per train for recirculation. We had an available NPSH of 2.5. That's at 195 degrees Fahrenheit, so it's at the initial recirculation --

CHAIRMAN WALLIS: It says "available." What does the pump need as a minimum NPSH?

MR. GASPER: Well, that's what we've got. I mean, the pump itself?

CHAIRMAN WALLIS: Yes.

MR. GASPER: It's on the order of, I believe, similar to the Salem pumps of 20/25 feet, the pump itself.

CHAIRMAN WALLIS: So this 2.5 is a margin on top of 25 feet, is that --

MR. GASPER: No. That's a calculation for water -- the rack yesterday that was shown for the system, that Salem showed. As you're coming up in temperature, your available NPSH goes down. And this was calculated at 195 degrees.

CHAIRMAN WALLIS: That 195 degrees.

MR. GASPER: This would be the limiting amount of head that would be available for -- you could not go below less than 2½ feet of head loss--

CHAIRMAN WALLIS: So this will operate at 2½ feet at 195 degrees.

MR. GASPER: What?

CHAIRMAN WALLIS: The pump will still operate?

MR. GASPER: Yes. This is the calculation that says this is the amount of head loss that we have available for loss across the strainer. So as we test across the strainer, we couldn't get greater than 2½ feet.

CHAIRMAN WALLIS: Okay. Okay.

VICE CHAIRMAN BANERJEE: That takes into all the bends and --

MR. GASPER: Yes. That's a hydraulic model --

VICE CHAIRMAN BANERJEE: So you actually did the experiment or --

MR. GASPER: No, we used Protoflow to do the calculation. No.

VICE CHAIRMAN BANERJEE: You ever ran these pumps before?

MR. GASPER: Oh, those pumps are run. Those are also run for the shutdown cooling.

VICE CHAIRMAN BANERJEE: So eventually you --

MR. GASPER: You run them at cold.

VICE CHAIRMAN BANERJEE: Yes, you know what they are.

MR. GASPER: Yes. The code is benchmarked at the cold temperatures for the refueling conditions.

The debris generation in transport was done by Alion. We generally followed the NEI 04-02 guidance.

We used CFD to calculate the flow velocities in containment during recirculation. And then calculated the turbulent kinetic energy, used the information in the NEI 04-02 or NEI 04-07 to determine the fractions of the various insulation debris, et cetera, that were transported to the strainer.

VICE CHAIRMAN BANERJEE: You're going to tell us more about that?

MR. GASPER: I will tell you more about

the latest runs we've been making with the computation --

VICE CHAIRMAN BANERJEE: Is this allowing you to claim some credit for material dropping out?

MR. GASPER: No. We strictly used the CFD to calculate fluid flow velocities. The material was originally assumed to be uniformly spread over the floor of the containment. And then based on total kinetic energy the transport fractions were calculated. The total kinetic energy is calculated by the CFD code -- turbulent kinetic energy, excuse me. And then applying that to the information that looked at tumbling, et cetera, determined what the debris that would be transported to the strainer itself.

VICE CHAIRMAN BANERJEE: So you're going to discuss this in some detail?

MR. GASPER: Yes. I'm going to discuss it in some detail since we've gone to considerably lower flows now.

VICE CHAIRMAN BANERJEE: Okay. Yes.

MR. GASPER: You can see there is a result on slides 20 and 21 of the debris being transported from the alpha bay and from the bravo bay. There are different leadings on the two. And both debris loads were included in the test.

In addition, there was also a small break load that strictly was a coatings load that was included in the test program. So there were three separate debris loads included in the test program.

CHAIRMAN WALLIS: How does this differ from what's on page 54. I'm sort of looking ahead. You got the same --

MR. GASPER: Fifty-four is the same arrangement, except that the --

CHAIRMAN WALLIS: That stuff gets to the strainer, though.

MR. GASPER: Those are the transport calculations for only the high pressure safety injection pump recirculation.

CHAIRMAN WALLIS: So there's something different about that?

MR. GASPER: They are very low velocities. We did some additional testing to validate the use of the CFD for the very low velocities that we're going to be seeing.

VICE CHAIRMAN BANERJEE: Now, what fraction of the total debris form is this? For example, you have 49 --

CHAIRMAN WALLIS: You've got a small amount of Cal-Sil.

VICE CHAIRMAN BANERJEE: Yes.

CHAIRMAN WALLIS: There was a total amount of --

VICE CHAIRMAN BANERJEE: So how much Cal-Sil actually is in the debris?

MR. GASPER: Well, I believe in this case the Cal-Sil was 100 percent transported because--

VICE CHAIRMAN BANERJEE: So you only produced 49 cubic feet of Cal-Sil?

MR. GASPER: Yes, depending on the ZOI.

CHAIRMAN WALLIS: That's because of the ZOI?

MR. GASPER: Because of the ZOI.

CHAIRMAN WALLIS: Because you've got what? Eight hundred cubic feet or something of Cal-Sil, you got 700 or whatever -- I forget what the number was.

MR. GASPER: Yes, I don't remember now.

CHAIRMAN WALLIS: In the total building there's a lot of Cal-Sil.

MR. GASPER: Yes. But a lot of it is on

small lines that are outside the biological shield. So they would not be in the ZOIs.

VICE CHAIRMAN BANERJEE: So you started with 1936 p cubed. After that you --

CHAIRMAN WALLIS: No, that came off.

VICE CHAIRMAN BANERJEE: -- cleaned it off.

MR. GASPER: Right.

VICE CHAIRMAN BANERJEE: And how much did you get down to?

MR. GASPER: Well, we took roughly a 1,000.

CHAIRMAN WALLIS: You got 750.

VICE CHAIRMAN BANERJEE: You have 750.

MR. GASPER: Yes.

VICE CHAIRMAN BANERJEE: And what ZOI did you use? How many diameters?

MR. CHOROMOKUS: Five.

VICE CHAIRMAN BANERJEE: Five diameters

MR. GASPER: Per Cal-Sil.

CHAIRMAN WALLIS: Was it that small?

MR. GASPER: It's per the guidance of the --

MR. CHOROMOKUS: I think it's 5.5.

MR. GASPER: Yes.

MR. CHOROMOKUS: It's in the NEI 04-07.

MR. GASPER: We used the standard in the NEI 04-07.

CHAIRMAN WALLIS: I thought Cal-Sil was pretty easy to remove.

VICE CHAIRMAN BANERJEE: Has this got an aluminum jacket.

MR. GASPER: Yes, there's an aluminum jacket. We've also actually sampled it. It appears to be different than the Cal-Sil that was tested in some of the NUREGs. It's extremely difficult to destroy. It takes considerable amount of hammering to turn it into fines.

VICE CHAIRMAN BANERJEE: So you tested it in --

MR. GASPER: Yes.

VICE CHAIRMAN BANERJEE: Where did you test it?

MR. GASPER: Alion has tested some of it for us for both erosion, and we also tested --

VICE CHAIRMAN BANERJEE: In a team jet?

MR. GASPER: No. No, just strictly for destruction type of thing. We have not tested it for -- for purposes of the analysis we've assumed the ZOIs and the destruction that's discussed in NEI

04-07.

MR. ARCHITZEL: Ralph Architzel from the Staff.

I wanted to just mention that the only insulation in the GR that was end phase tested was Cal-Sil by OPG. So that's where that number come -- it was adjusted up, et cetera. It was two-phased tested by OPG. That's the source of that number.

VICE CHAIRMAN BANERJEE: And so let's look at slide 20 again. The fact that A and B are different is indicative of the longer flow path?

MR. GASPER: Longer flow path and it's a different ZOI, yes.

VICE CHAIRMAN BANERJEE: So how can--

MR. CHOROMOKUS: There could be a different distribution of debris in that compartment.

MR. GASPER: Yes.

VICE CHAIRMAN BANERJEE: So i'd like to see what the fraction of this is, each of these, how much is left behind and how much is being transported.

So you're saying 100 percent of the Cal-Sil is transported?

MR. CHOROMOKUS: Fines, yes.

MR. GASPER: Yes, as fines. Yes.

VICE CHAIRMAN BANERJEE: As fines?

MR. CHOROMOKUS: Yes.

VICE CHAIRMAN BANERJEE: And then the others, Nukon? There's very little Nukon, I guess.

CHAIRMAN WALLIS: And fiberglass?

MR. GASPER: Yes, it's a high density fiberglass.

Basically the transport fractions I think were all consistent with the --

MR. CHOROMOKUS: Yes, we need to pull the Cal-Sil analysis for those numbers.

MR. GASPER: Yes. But the transport fractions I think were consistent with what we recommended in 04-07.

MR. CHOROMOKUS: And those would have been the same ones reviewed by the Staff during the audit.

MR. GASPER: Yes. And they were reviewed by the staff during the audit. There were no open items on that area.

VICE CHAIRMAN BANERJEE: Okay.

CHAIRMAN WALLIS: Is there an audit since the audit that we looked at? The audit I looked at you seemed to have not got very far with some of these things. But that was way back in --

MR. GASPER: 2005.

CHAIRMAN WALLIS: -- 2005 or something.

MR. GASPER: Yes.

CHAIRMAN WALLIS: So I assumed that you made tremendous progress since that?

MR. GASPER: Well, we've considerably changed our strategy since then.

CHAIRMAN WALLIS: So that audit should be forgotten?

MR. CHOROMOKUS: That would be nice.

MR. GASPER: There are clearly open items that we are factoring in our current strategy.

Slide 22 and 23. Twenty-two shows the test facility at CDI where the test is basically, this is the module test. It's basically --

CHAIRMAN WALLIS: Somebody's swimming pool is this?

MR. GASPER: Basically.

CHAIRMAN WALLIS: Right.

VICE CHAIRMAN BANERJEE: Where is CDI?

MR. LARSON: Ewing, New Jersey

VICE CHAIRMAN BANERJEE: New Jersey.

You are from CDI?

MR. LARSON: No, from General Electric.

MR. GASPER: No, General Electric.

MR. GASPER: But CDI was the --

CHAIRMAN WALLIS: GE did the testing.

MR. GASPER: Yes. CDI was the subcontractor.

VICE CHAIRMAN BANERJEE: Is the testing underway or is it completed now?

MR. GASPER: Testing has not been undertaken for the new parameters yet.

VICE CHAIRMAN BANERJEE: Okay.

MR. LARSON: It's scheduled for the middle of June.

CHAIRMAN WALLIS: So your test facility is just a big swimming pool with a few stacked disks in the middle of it?

MR. LARSON: Well, there's six different types of pools. The pool you're looking at right there is the swimming pool that was basically modified for some module testing. But we do have two large other pools that we use for module testing that we do BWR, a full size BWR stack and we do other modules in there. And then we have a rectangular pool that we do module testing in. And then we have two sector tanks for testing. So we have approximately seven different types of pools that we use.

CHAIRMAN WALLIS: Yes. The question with all of these approaches is how well the experiment represents the plant. And I think in your presentation the only thing I see is this particular pool here, this particular swimming pool.

MR. GASPER: This was --

CHAIRMAN WALLIS: It doesn't really indicate how you did the test.

MR. GASPER: Well, this was for the 2005 test. Well Eric or Nick could describe the testing we did in 2005.

CHAIRMAN WALLIS: This is the August 29 to September 1?

MR. GASPER: Yes.

CHAIRMAN WALLIS: This is the one where a large proportion of the debris settled to the floor?

MR. GASPER: Yes.

MR. LARSON: Right. And we've changed the entire philosophy based on --

CHAIRMAN WALLIS: So I should forget that test?

MR. LARSON: Yes. That test was --

CHAIRMAN WALLIS: Forget that test?

Okay.

VICE CHAIRMAN BANERJEE: Now you're going to suspend all your debris, hopefully?

MR. LARSON: Well, it all depends on the testing that you're doing at that time. The debris is normally agitated to maintain so you get a 100 percent debris onto the face of the strainer, depending on the testing.

VICE CHAIRMAN BANERJEE: How are you agitating the pool?

MR. LARSON: We agitate the pool, this was discussed in yesterday's presentation, using mechanical agitators and also using the flow to ensure that all the debris maintains itself onto the strainer. And then we inspect to make sure that the debris is on the strainer.

VICE CHAIRMAN BANERJEE: The debris doesn't lie around on the pool floor?

MR. LARSON: There is different testing depending on the flow that you can take credit for, such as on a module test we can actually mock up the physical location of the strainer, scale -- scale the flow rates to the strainer and then allow the debris to enter and determine how it facilitates that. So there is one that could --

CHAIRMAN WALLIS: So these stir tests you stir and then you keep straining under the debris disappears and it's all on the strainer, is that what you do?

MR. RAMSAUR: That's correct.

CHAIRMAN WALLIS: So you just keep stirring and straining until the pool is clear?

MR. RAMSAUR: In some cases the pool is clear. You can see the bottom of the tank.

VICE CHAIRMAN BANERJEE: This second strategy seems difficult to justify, I would say. You're trying for similitude in some way, right?

MR. RAMSAUR: That's right.

VICE CHAIRMAN BANERJEE: What are the nondimensional groups of this similitude that you're striving for? I suggest you don't do it, it's almost impossible to get it, really.

I think this uniform mixing sounds really okay.

CHAIRMAN WALLIS: As a limiting basis.

MR. LARSON: Yes. That's very conservative.

MR. LARSON: We had --

VICE CHAIRMAN BANERJEE: I don't know if it is or not, but it is a case which has some legs, if you like.

CHAIRMAN WALLIS: It all ends up on the strainer --

VICE CHAIRMAN BANERJEE: It all ends up there.

CHAIRMAN WALLIS: -- but how it's distributed might or not be conservative.

VICE CHAIRMAN BANERJEE: Yes. Yes. I won't agree it's conservative, but certainly it is--

CHAIRMAN WALLIS: Well, this looks like an awfully small amount debris in picture 24. I thought your strainer was -- looking at the amount of debris you have to handle and the size of the strainer, it just doesn't look like very much.

MR. RAMSAUR: Well, when you have Cal-Sil, then it's usually -- you know, it doesn't take very much Cal-Sil to end up with high head losses on the strainer.

MEMBER ABDEL-KHALIK: How does the ratio between the volume of the pool and the surface area of the strainer plates that you're testing compare to the ratio between the volume of the containment and the surface area of the entire strainer?

MR. RAMSAUR: Could you repeat that question again?

MEMBER ABDEL-KHALIK: I'm just trying to see if the size of the pool, the swimming pool in which you're doing the testing has any impact on your results. And the question is how does the ratio between the volume of this pool to the surface area of the fuel plates that you're testing compare to the total volume of the containment, the water in the containment, to the surface area of the entire strainer?

MR. RAMSAUR: And I can't answer that question right now. It's something we didn't really evaluate.

MEMBER ABDEL-KHALIK: Wouldn't that ratio affect the results inasmuch as it would affect essentially the particle density, the average particle density in the pool?

CHAIRMAN WALLIS: Now if I look at page 20 --

MR. RAMSAUR: I guess -- I would think that since we're delivering the debris to the strainer, to the vicinity of the strainer, why I would say that that wouldn't have too much to do with it.

MEMBER ABDEL-KHALIK: But that's sort of, you know, something that you can't really control very well, can you?

MR. RAMSAUR: What's that?

MEMBER ABDEL-KHALIK: The area around the strainer in which all this stuff presumably is done?

MR. RAMSAUR: Well, you can control it to a certain extent. I mean, we can put up walls and --

MEMBER ABDEL-KHALIK: But, I mean, you actually put walls around that, on the strainer --

MR. RAMSAUR: Yes, we do.

MEMBER ABDEL-KHALIK: -- to control the volume?

MR. RAMSAUR: Yes. Our new testing program where we're trying to simulate the actual geometry of the containment. And that effects the strainer.

MEMBER ABDEL-KHALIK: So again the question is how does the volume of that contained area, the ratio between the volume of that contained area to the surface area of the fuel plates that you're testing compare to the ratio between the volume of the containment and the total surface area of the strainer?

MR. RAMSAUR: Okay. I don't know that.

MR. LARSON: Yes. We're going to have to take that to get that answered.

I mean, right now what we do is -- I mean, specifically you're taking the test article that you do put in that is basically geometrically scaled on a unit basis to, say, Fort Calhoun's and then using the pool you come up to a volume size to ensure -- be also ensuring all the debris does get to the strainer. That, you know, a 100 percent to the strainer for their testing.

So from a water volume -- because you're asking a water volume in the pool size type of question. And in this picture probably doesn't dictate well that we wouldn't be doing the type of module testing for Calhoun in this pool any more. We'd actually be doing it in a smaller pool.

MEMBER ABDEL-KHALIK: I mean, this is a full size plate, isn't it, or is this a scaled plate?

MR. RAMSAUR: No, the plats are full size.

MEMBER ABDEL-KHALIK: Full size.

MR. LARSON: The plates are full size.

MEMBER ABDEL-KHALIK: So really the ratio is just the ratio between the number of plates?

MR. LARSON: Correct.

VICE CHAIRMAN BANERJEE: If you want to look at the typical geometry, Said, you can look at slide 48 in the vicinity of the strainer. The strainer is on the left hand side between the 8 and 9 position.

There must be enormous flow. What is the recir rate in feet per minute, or whatever? Give me any units.

MR. GASPER: Well, in this test --

VICE CHAIRMAN BANERJEE: Not in the best

MR. GASPER: No, no.

VICE CHAIRMAN BANERJEE: In the system?

MR. GASPER: Okay. That CFD was run at 1350 gpm. That is not -- I need to separate here two things.

The testing that was run in 2005 was run for roughly 4,000 gpm recirculation rate. And that's what we're talking about back on slide 24.

VICE CHAIRMAN BANERJEE: Okay. We're just trying to get an idea what the flow rates.

MR. GASPER: Yes.

VICE CHAIRMAN BANERJEE: 4,000 gpm?

MR. GASPER: Yes. That's with one

containment spray and one high pressure safety injection pump. It's around 4,000 gpm.

VICE CHAIRMAN BANERJEE: 40,000 pounds.

CHAIRMAN WALLIS: Have you ever operated twice that rate? Do you ever operate both?

MR. GASPER: Yes.

CHAIRMAN WALLIS: So you do? So you could go to 8,000 gpm?

MR. GASPER: We could. We could. We could.

VICE CHAIRMAN BANERJEE: There's roughly--

MR. GASPER: But recognize that each one of those is pulling on one strainer.

VICE CHAIRMAN BANERJEE: It's off the order of 800 to 1600 cubic feet per minute, right? That's what I come up with. I don't know what you come up with.

CHAIRMAN WALLIS: I'm trusting you.

VICE CHAIRMAN BANERJEE: I don't trust my algebra.

CHAIRMAN WALLIS: This is arithmetic.

MR. GASPER: Well, 450 gpm is roughly 1 cubic feet per minute, if I remember correctly. That's basically one of HPSI pumps.

VICE CHAIRMAN BANERJEE: So I come up with velocities -- what is the area of your strainers, the outer superficial area? It's how much by how much by how much.

CHAIRMAN WALLIS: It's 4 by 3 by 8, I think, isn't it?

MR. GASPER: Approximately.

VICE CHAIRMAN BANERJEE: So that's 24 by 4. So roughly 100 feet squared? So you have a very, very -- you have a velocity of something like -- it depends on the flow rate.

CHAIRMAN WALLIS: That's why everything is transported to the strainer.

VICE CHAIRMAN BANERJEE: Yes. It's quite a velocity.

MEMBER ABDEL-KHALIK: I think it would be a good idea to sort of clarify the scaling that you went through to show the prototypicality of the experiments vis-à-vis the actual system.

MR. LARSON: Right. And your specific question on the scaling was the pool size to the test article?

MEMBER ABDEL-KHALIK: But in general. I mean how do you --

CHAIRMAN WALLIS: Why does this

represent the reality?

MEMBER ABDEL-KHALIK: Right. Right. In general. Not just that particular parameter. How do you convince yourself and others that this set of experiments is prototypical or representative of what actually happens in the actual system?

CHAIRMAN WALLIS: I think they're going to show it's conservative, isn't that the --

MR. LARSON: It's conservative, yes.

MEMBER ABDEL-KHALIK: Well, you know, whether it's conservative or best estimate, we'd like to just see the detailed process.

VICE CHAIRMAN BANERJEE: How high is the water? Three and a half feet? I looked up your numbers for you.

CHAIRMAN WALLIS: Huge?

VICE CHAIRMAN BANERJEE: Yes, it's enormous.

CHAIRMAN WALLIS: Does this RMI get inside between the plates of the strainer? When you do the test. You said that the strainer's completely covered with debris. I'm reading ahead to 25. Does the RMI get in between the plates?

MR. RAMSAUR: No. The basic coating is with the combination of Cal-Sil and fiber.

CHAIRMAN WALLIS: That's what gets inside.

MR. RAMSAUR: Yes, it gets inside.

CHAIRMAN WALLIS: And the -- falls outside, is that high it happens.

MR. RAMSAUR: It would pile around the base.

MR. LARSON: Around the base.

CHAIRMAN WALLIS: It piles up around? It doesn't get inside?

VICE CHAIRMAN BANERJEE: What is the spacing between the wall and the containment wall?

CHAIRMAN WALLIS: The biological shield and the --

VICE CHAIRMAN BANERJEE: Yes, where that river of water is coming through.

MR. GASPER: The spacing, it's roughly 18 inches.

VICE CHAIRMAN BANERJEE: No, no, no. If you look at slide 48 if you look at the biological shield and the containment wall --

MR. GASPER: Oh.

VICE CHAIRMAN BANERJEE: -- what is that distance?

MR. GASPER: Eight feet.

VICE CHAIRMAN BANERJEE: Eight feet.

MR. GASPER: Yes.

CHAIRMAN WALLIS: Here are some people standing here.

VICE CHAIRMAN BANERJEE: Yes.

CHAIRMAN WALLIS: Eight feet looks about right.

MR. GASPER: Yes, it's about eight feet.

VICE CHAIRMAN BANERJEE: Let's call it two meters.

CHAIRMAN WALLIS: So we got to wait for you to do this calculation or are we going to go ahead.

VICE CHAIRMAN BANERJEE: No. Go ahead.

CHAIRMAN WALLIS: I'd like to go ahead with your presentation.

MR. GASPER: Okay. I'll keep going.

CHAIRMAN WALLIS: He's doing his exam here.

MR. GASPER: Anyway, 2005 results was a single strainer of about 1500--

CHAIRMAN WALLIS: Are you going ahead? Where are you?

MR. GASPER: I am on slide 25.

CHAIRMAN WALLIS: Okay. That's where I

thought you were. Okay. That's better.

MR. GASPER: Okay. I'm on slide 25. During the 2005 testing with debris only we ended up with a strainer of about 1500 square feet.

CHAIRMAN WALLIS: So I calculated then that you have about an inch of fiberglass and a half inch of Cal-Sil on each face here.

MR. GASPER: Yes.

CHAIRMAN WALLIS: So you pretty well fill the space in between here with Cal-Sil and fibers, the picture on page 24? You fill the space in between the screens or whatever you call them?

MR. GASPER: We ended up basically with three-tenths of NPSH margin.

CHAIRMAN WALLIS: You fill the gap between these --

MR. GASPER: Well, you don't necessarily--

MR. RAMSAUR: See, when we did this test we were actually scaling on a plant strainer of 1500 square feet.

CHAIRMAN WALLIS: That's right. But I took feet of debris per square foot of surface area, you know amount of debris for units of surface area is the way you scale it, right? So I took all the debris, it's about 100 cubic feet of fiberglass and I put it on 1500 feet square. That's why I got about an inch of fiberglass. And that's, I guess, how you scale it. You scale it as massive debris per unit area of strainer. It's the same loading on the strainer. It must be by the way you scale.

MR. RAMSAUR: Yes. We scale the debris according to the size of the test article.

CHAIRMAN WALLIS: Right. Massive debris per your unit area of strainer.

MR. RAMSAUR: Right. Right.

CHAIRMAN WALLIS: Okay. So I get about an inch of fiberglass and a half inch of Cal-Sil, which looks to me as if it's enough to fill the gaps between these disks.

VICE CHAIRMAN BANERJEE: We had the same problem with Vermont Yankee.

CHAIRMAN WALLIS: So you fill the gaps between the disks, right?

MR. RAMSAUR: Actually, as I recall the testing, we did not have a full gap condition.

CHAIRMAN WALLIS: But there's enough mass to fill it. So does it pile up around it?

MR. RAMSAUR: No.

CHAIRMAN WALLIS: Well, I think all this

needs to be clear. I mean, you're going to make it clear to the Staff. We're going to audit you, but the Staff is, presumably.

VICE CHAIRMAN BANERJEE: Just for your purposes the Reynolds numbers are between 100 and 500,000 in that stream. So you are extremely turbulent because very little is going to sit anywhere.

CHAIRMAN WALLIS: Well, we're going to get turbulent soon.

VICE CHAIRMAN BANERJEE: Yes.

MR. GASPER: Yes.

CHAIRMAN WALLIS: I think you need to clarify what's going on here.

MR. GASPER: This was the 2005. Recognize that this is not what we're going forward with.

CHAIRMAN WALLIS: Well, it would be useful to show pictures of what you got when you got this simulated 1500 square feet. You know, a picture corresponding to slide 25 would be good in place of slide 24. And then maybe as you took it apart and took off and sort of scraped away the reflective metal stuff, you could see what it looked like inside and so on. So it's clear what happened.

MR. GASPER: I believe --

MR. RAMSAUR: See, but the item that's missing here is you don't know what the size of the test article was.

CHAIRMAN WALLIS: I don't care.

MR. RAMSAUR: Well, you care if you're trying to calculate --

CHAIRMAN WALLIS: I just don't want to care about the --

MR. RAMSAUR: -- the amount of fiber.

CHAIRMAN WALLIS: That doesn't matter. I've got 1500 square feet of surface area in the real thing and I've got 100 cubic feet of fiberglass in the real thing. So I've got one cubic foot of fiberglass per 15 square foot of strainer. I don't care how many disks you use as long as you keep that fixed, it's going to look much the same.

But you're going to explain. I'm not going to have to explain to it, which is you're going to explain to me what you did.

MR. GASPER: Okay. I think the bottom line for our 2005 testing was we ended up with very little NPSH margin. We had an open item --

MEMBER ABDEL-KHALIK: That assumes all pumps are operating or one set of pumps not operating?

MR. GASPER: This is per train. This is 1500 square per train.

MEMBER ABDEL-KHALIK: The pressure drop in the strainer presumably enters into this calculation to come up with a net positive section head margin.

MR. GASPER: Right. And there's --

MEMBER ABDEL-KHALIK: So the flow rate that you're assuming for the total strainer is based on what? Two sets of pumps or three sets of pumps?

MR. GASPER: There's one containment spray, one high pressure safety injection pump per train pulling on one strainer.

MEMBER ABDEL-KHALIK: Okay.

MR. GASPER: So that's what the calculations are based on.

VICE CHAIRMAN BANERJEE: I guess the concern which you must have noted is that the disk free area can get clogged up with the material if it's all suspended. So that your approach velocity is no longer the approach velocity for the strainer, but it's the official approach velocity and you have to go through this fiber bed to get through that stuff? Did you follow what the issue is?

Imagine that the spaces all got clogged up --

MR. GASPER: Correct.

VICE CHAIRMAN BANERJEE: -- which is back of the envelop calculations showed might happen. Maybe it doesn't happen. But if it does happen, then what you've got is the flow going through this fiber bed or whatever debris it is to the strainer openings, which means that when you test these strainers, they should be tested under conditions where they do get all clogged up. That sets a --

CHAIRMAN WALLIS: Well, probably they do, but they just haven't told us that.

VICE CHAIRMAN BANERJEE: Yes.

MR. LARSON: Yes. We tested at a range of different.

VICE CHAIRMAN BANERJEE: Right.

MR. LARSON: To determine the maximum head loss that can occur and then focus on that head loss. So you go from a range of the maximum fiber load all the way down to the thin bed that can occur to determine which one can cause the maximum head loss --

VICE CHAIRMAN BANERJEE: Right.

MR. LARSON: -- for each strainer design.

VICE CHAIRMAN BANERJEE: But one asymptote of this is if all the stuff was suspended, which is probably what will happen because you have a turbulent fluid at such a high Reynolds number, it all gets delivered to this strainer now. You know, that would be a reasonable assumption to make. It's not the worst possibly because you get mal-distribution effects which can make it actually worse. But let's assume it all goes sort of uniformly and clogs this stuff up, then you got to do a test to show that that is acceptable unless you make much larger area, in which case it won't clog up.

I mean, it's really these gaps filling up that we've got --

MR. GASPER: Correct.

VICE CHAIRMAN BANERJEE: So if you have a huge number of gaps, then it may not matter.

CHAIRMAN WALLIS: I don't think they care. They just throw the stuff in, run the pump and show that they've only got .3 feet of NPSH whatever, whatever the pressure drop is, and they don't care how they get that pressure drop. You don't sort of try to analyze it. You just do an experiment and see what head loss you get, isn't that what you do?

MR. LARSON: Correct. At different debris loads or different --

CHAIRMAN WALLIS: Different debris loads, you get different head losses?

MR. LARSON: You get different head losses.

CHAIRMAN WALLIS: Right. So it would help if you had a presentation where you actually showed the different debris loads or something. You know, this is a skimpy presentation so far in terms of what you did.

MR. LARSON: We can provide all that.

MR. GASPER: I think the key here is that we had almost no head loss margin. We had an open item --

CHAIRMAN WALLIS: Okay.

MR. GASPER: -- at the pilot audit where we clearly had near field effects and that we had not included chemical debris.

CHAIRMAN WALLIS: What do you mean by near field effect?

MR. GASPER: That has to do with the settling of the debris at the base of the strainer.

CHAIRMAN WALLIS: Okay. So you want to take credit for the debris settling?

MR. GASPER: That was an open item from the NRC audit?

CHAIRMAN WALLIS: Yes.

MR. GASPER: I think what I'm trying to go through this presentation is that at that point in time with the testing we had done without chemical effects we had very little head loss margin.

CHAIRMAN WALLIS: Oh, okay.

MR. GASPER: We did periodically capture debris downstream during the testing. The debris was weighed but not characterized. And at that time the testing was run to maximize head loss, not debris bypass. Subsequently, the testing has been revised to --

CHAIRMAN WALLIS: So you had a margin of .3 feet. What was the head loss across the screen when you had that?

MR. GASPER: Roughly 2.2.

CHAIRMAN WALLIS: 2.2.

MR. GASPER: We had 2.5 total.

CHAIRMAN WALLIS: So if you had been in error by ten percent, you might have lost most of your available margin?

MR. GASPER: We had very little margin.

MR. GASPER: You had very little margin, yes.

MR. GASPER: That led us to some --

CHAIRMAN WALLIS: Right.

MR. GASPER: As we start going through, we'll see why --

CHAIRMAN WALLIS: You presumably would like to have more margin?

MR. GASPER: Yes.

CHAIRMAN WALLIS: Okay.

CHAIRMAN WALLIS: And the Staff is working on it with you?

MR. GASPER: We have proposed an alternative and we'll get to that.

Ex-vessel, going to slide 27. I'm not going to go through any details here.

Ex-vessel we utilized the Rev. 0 methodology. The only component we ended up with having not determined to be acceptable is the cyclone separator. And we have that to resolve still. And then on in vessel, we hadn't done anything. We're depending on the PWROG report to be relevantly --

VICE CHAIRMAN BANERJEE: So the ex-vessel you didn't have throttling valves or anything?

MR. GASPER: We did not identify anything with orifices; throttling valves, bearings, et cetera.

VICE CHAIRMAN BANERJEE: And the cyclone separator, was that to do what?

MR. GASPER: The cyclone separator is upstream at a high pressure safety injection pumps to separate debris at the inlet of those.

VICE CHAIRMAN BANERJEE: So it's an essential item?

MR. GASPER: It's not clear that it's essential.

CHAIRMAN WALLIS: So it might clog up, presumably?

MR. GASPER: It's more a case that the manufacturer states that you can only take, I think, 3 micron. It's the statement of what the manufacturer states is acceptable. There has been testing done by a couple of utilities on those showing that they will survive the debris, et cetera. It's not a case of --

VICE CHAIRMAN BANERJEE: They're meant

to separate out the debris, right?

MR. GASPER: Yes. But there's a case -- it's the manufacturer's specification that we run into the problem.

VICE CHAIRMAN BANERJEE: How big are these pipes leading in and out of it?

MR. GASPER: I believe the --

VICE CHAIRMAN BANERJEE: The standard hydroclone, I take it?

MR. GASPER: I think they're a four or a six inch line, I believe.

VICE CHAIRMAN BANERJEE: Going in?

MR. GASPER: Yes. I believe.

VICE CHAIRMAN BANERJEE: Okay.

MR. GASPER: Anyway, that's the one component that I --

CHAIRMAN WALLIS: So the question is really whether the debris can get out of this cyclone fast enough?

MR. GASPER: Right. Or actually it has to do with whether or not the cyclone separator will continue to operate.

CHAIRMAN WALLIS: But if the outlet can't handle the flow of debris, then it just clogs up solid?

MR. GASPER: It's not a question of clogging. It's a question of whether or not the cyclone separator with its internals will continue to operate. So --

CHAIRMAN WALLIS: Okay. Well, that's going to be cleared up.

MR. GASPER: -- anyway, that's an issue that we got to clear up.

And went through a lot on chemical effects yesterday. Clearly, the chemical, we still get a fair amount of chemical precipitates discussed on slide 28.

CHAIRMAN WALLIS: You're going to get 100 kilograms of --

MR. GASPER: That's the calculation using the current BWR OG model. With the inhibition effects you could still get around 50 kilograms.

CHAIRMAN WALLIS: Well, that's going to destroy your margin?

MR. GASPER: Yes.

CHAIRMAN WALLIS: So what are you going to do about it?

MR. GASPER: Okay. That's where we're leading to.

VICE CHAIRMAN BANERJEE: This was with

the old buffer or with your new buffer?

MR. GASPER: That's still with the new buffer. That's with the new buffer because the precipitates we get are sodium aluminum silicate and aluminum oxyhydroxide.

CHAIRMAN WALLIS: Where does the aluminum come from?

MR. GASPER: There is aluminum in containment.

CHAIRMAN WALLIS: But we don't have aluminum covered insulation anymore?

MR. GASPER: That's right. But we do have some coolers, we do have aluminum fittings in the containment. And we still have some insulation that has aluminum jacket on it.

VICE CHAIRMAN BANERJEE: It is submerged, all this stuff or is it exposed to the spray?

MR. GASPER: Both.

VICE CHAIRMAN BANERJEE: Both?

CHAIRMAN WALLIS: You've got a pound of aluminum oxide per square foot of strainer? That's an awful lot.

MR. GASPER: Yes.

CHAIRMAN WALLIS: Closes up completely?

MR. GASPER: If you do not have a debris free area on the strainer, you would clog it up completely.

CHAIRMAN WALLIS: Right.

MR. GASPER: There was a question just here yesterday. I did go back and look and see how mich aluminum was dissolved by the model. And the calculations I had showed between 20 and 30 percent of the aluminum is dissolved.

CHAIRMAN WALLIS: Oh.

VICE CHAIRMAN BANERJEE: This was all over 30 days?

MR. GASPER: Over 30 days.

VICE CHAIRMAN BANERJEE: Yes.

CHAIRMAN WALLIS: Quite a lot.

MR. GASPER: You asked that question yesterday, so I went back and looked at the model last night.

We looked at several options relative to chemical effects. One was obviously was to remove all aluminum out of containment. That's not very feasible because the main fan coolers have aluminum in there. It would be a major evolution.

The insulation is obviously a problem because we have asbestos in it. And the size of the strainers was going to have to be very large. And there's only so much room in that containment. It's a very little containment.

Moving on to slide 30. In May of 2006 NEI and the NRC met relative to implementation of water management, which is to not use the containment sprays.

Fort Calhoun has fully redundant trains of containment fan coolers and containment sprays. We have opted to move ahead with the option of eliminating or not turning on the containment sprays during a LOCA. The containment sprays will activate during a steam line break. We need those for steam line break safety analysis. This will result in considerably less debris transport to the strainers. It increases our NPSH from 2.5 feet to 5.3 feet.

MEMBER KRESS: Because the containment pressurizes?

MR. GASPER: No. Because we're now only recirculating a high pressure safety injection pumps. We no longer are going to recirculate on containment spray pumps.

And generically there's now a class of LOCA by doing this, you move your recirculation, start of recirculation out in the neighborhood of 60 minutes on the worst case. So you now between double and triple the amount of time you maintain an injection phase.

This now means that you've got a class of LOCAs that you previously went on recirculation with that you no longer have to, that you'll be able to go on shutdown cooling with. So there's an overall reduction in the CDF generically of around ten percent. We haven't calculated the specifics for our plant yet.

MEMBER ABDEL-KHALIK: How does this sort of elimination of automatic initiation container spray effect the maximum containment pressure during a large break LOCA?

MR. GASPER: We've got the analysis done or we're doing the analysis. Basically we previously had only credited sprays and now we're accrediting fan coolers and the effect is -- actually the containment pressure is slightly less because the fan coolers in our case actually sequence on earlier than the containment spray pumps do. But we're just now in the position where we're finishing up that analysis and preparing a license application to amend our license basis. And --

VICE CHAIRMAN BANERJEE: If I understand

it right, containment spray will still come on for the steam line?

MR. GASPER: Steam line break.

VICE CHAIRMAN BANERJEE: So what is the logic system which will allow you to seek out something like that?

MR. GASPER: Okay. On page 32. Basically we initiate, it's called CSAS. It was logic. And that was that previously upon pressurizer PPLS, which is pressurizer pressure low, CPHS is containment pressure high we initiated both the containment sprays and the containment fan coolers. We're going to change that logic to such that now that only initiates the containment coolers, AND gate in and steam generator. SGLS is the steam generator pressure. We'll put that into an AND gate. And that would now initiate the containment spray, open up the containment spray valves to spray containment.

MEMBER ABDEL-KHALIK: This is steam generator level?

MR. GASPER: Steam generator pressure.

MEMBER ABDEL-KHALIK: Pressure.

MR. GASPER: It's a bit of a misnomer in our logic, but it's actually steam generator pressure.

CHAIRMAN WALLIS: It looks like level here.

MR. GASPER: Yes, I understand that. And I don't know why that was put in. I probably should have changed it, but that's right out of our diagrams.

CHAIRMAN WALLIS: Now while you're doing this, you still have the same amount of chemical precipitate foam? You've got less debris, but you--

MR. GASPER: Actually, no. We will now have considerably less because we will no longer be spraying aluminum down. We only have to consider submerged aluminum.

CHAIRMAN WALLIS: Okay. So you will be able to predict less?

MR. GASPER: Yes. And the amount of aluminum that's submerged is a relatively manageable amount and certainly could be replaced if necessary.

CHAIRMAN WALLIS: The problem is we don't know quantitatively how to predict the effect of aluminum oxyhydroxide on head loss. We just know that it can have large effects, but we don't have a formula that says what you need.

MR. GASPER: That's right.

CHAIRMAN WALLIS: Well don't we desperately need some kind of a formula that says if you have more than a certain amount, you clog the screen or something?

MR. GASPER: That would be great, but I don't know of --

CHAIRMAN WALLIS: Well, you can say have a minuscule amount and you still have to answer that question does it clog the screen.

MR. GASPER: I mean some testing will lead you to the conclusion that one gram of precipitate can clog one square foot.

CHAIRMAN WALLIS: Well, this would seem to be a real problem. You've got to have a quantitative prediction capability for aluminum oxyhydroxide.

MR. GASPER: In my view I have -- from an economic point of view I have a choice of testing or just pulling the aluminum.

CHAIRMAN WALLIS: Yes. So you test?

MR. GASPER: I don't know yet which is--

CHAIRMAN WALLIS: Oh, you don't know yet?

MR. GASPER: I don't know yet. I haven't seen my prices yet.

VICE CHAIRMAN BANERJEE: Or you can take the buffer out, right? What happens if you do that?

MR. GASPER: Right now the radiological analysis -- I'd have to turn to Michelle. But I believe all the radiological analyses to the point are saying maintain, we have to achieve a buffer of seven. So that would be a major licensing iteration to go through at this point in time.

MR. KLEIN: Paul Klein from NRR.

I guess another option that's available is to remove sufficient fiber so that you end up with bare strainer.

MR. GASPER: That's true, yes.

CHAIRMAN WALLIS: If you can demonstrate that. But then if you do it in the swimming pool, you're probably going to get some sort of fibers over the whole screen area.

MR. KLEIN: It's a plant specific parameter. Some plants have very low amount of fiber.

VICE CHAIRMAN BANERJEE: But they have problems to remove all the fibers, right, because of radiation doses.

MR. GASPER: And asbestos, yes.

CHAIRMAN WALLIS: Anyway, you're working

on it.

MR. GASPER: Yes.

VICE CHAIRMAN BANERJEE: Sounds like a plan.

MR. GASPER: So that's why we went down this option because we were running out of any other good options.

CHAIRMAN WALLIS: Now you don't have room to put in more strainers?

MR. GASPER: No. Certainly on one side of the strainers, we quickly run out of run. We're into a regenerative heat exchanger room.

CHAIRMAN WALLIS: Where did this 2800 square feet come from then?

MR. GASPER: The 2800 square feet came from the initial testing in 2005, that's where we had the .3 foot of NPSH margin. And that ain't going to cut it with chemical debris.

CHAIRMAN WALLIS: But then now you're saying you need 1500. I just wondered --

MR. GASPER: Well, the 2850 -- it was actually greater -- it's actually between 1400 and 1500 square foot per strainer. I rounded up. That was rounded down.

CHAIRMAN WALLIS: That's why it's twice

as much?

MR. GASPER: Yes. Well, 200 square feet difference.

CHAIRMAN WALLIS: Okay.

MR. GASPER: I rounded up. That one was rounded down.

CHAIRMAN WALLIS: And that's with no chemical effect?

MR. GASPER: That's strictly debris load.

VICE CHAIRMAN BANERJEE: So what aluminum is under the water level?

MR. GASPER: There is what's called nuclear detector well cooling. It cools the bioshield around the nuclear detector wells. That's got aluminum in it.

There's some jacketed insulation that still has aluminum on it.

And there are electrical outlets, fittings. Basically the weld fittings that have aluminum.

That's the three sources that are submerged. And clearly there are options. The biggest, we've already priced replacement our replacement cooling unit to go to copper as opposed to aluminum.

CHAIRMAN WALLIS: So you have to fix this by next year, is that it?

MR. GASPER: We will fix it during our next outage.

CHAIRMAN WALLIS: You're fix everything so that you won't have any problems convincing the Staff that it's safe to operate?

MR. GASPER: We will be in compliance with GL 04-02.

VICE CHAIRMAN BANERJEE: Well, turning off the spray certainly is something --

CHAIRMAN WALLIS: It helps.

VICE CHAIRMAN BANERJEE: Yes.

MR. GASPER: It helps a lot.

VICE CHAIRMAN BANERJEE: We looked at that quite a bit.

MEMBER ABDEL-KHALIK: Well, how long does it take for the containment high pressure signal to be reached?

MR. GASPER: A fraction of a second.

MEMBER ABDEL-KHALIK: The set point? What is the set point for the containment high pressure? Is it 4 psi?

MR. GASPER: Yes.

MEMBER ABDEL-KHALIK: And how long does it take to reach that?

MR. GASPER: On a large break, fraction of a second or so. I don't remember. I'd have to go back and look at the delay times in the table. But it's quick. I mean for all intents and purposes, it's instantaneous.

VICE CHAIRMAN BANERJEE: So you increase your margins, right, because of the sprayers?

MR. GASPER: Yes.

VICE CHAIRMAN BANERJEE: Yes.

CHAIRMAN WALLIS: Okay. We ready to go on.

MR. GASPER: Yes. Just quickly in the licensing area. One of the changes we've had to make is to the GOTHIC model, the mass and energy release model was overly conservative in long term analyses. It basically ended up calculating super heat as you transitioned from the RELAP generated mass and energy The methodology change has been implemented. And we're now showing our post-LOCA temperatures are within our EQ envelope, which was the biggest challenge we had. The pressure response was very acceptable. So that's a change we're going to be submitting to the Staff.

The other change is that on the dose analysis we're now crediting the -- we are an alternate source term plant. We're crediting the HEPA filters for the retention of the iodide aerosoles. Basically we have roughly the capability of each train can recirculate 100,000 CFM, and we got a million cubic feet in containment. So even on a single train we recirculate the air in the containment once every ten minutes. So by crediting the HEPA filters, we're able to hold up close to the iodide aerosoles that are released and we are taking credit for that. And that brings us in compliance with the control room and off site dosage issues.

I'm going to move to slide 35.

In preparation for the strainer testing we have revised the debris generation and going to multiple ZOI. And this methodology is discussed in Appendices II and VI of the SER on 04-07. This methodology basically goes through a process that we're using a single ZOI, we use multiple ZOIs.

We also went to 5D on the qualified coding based on the testing that was discussed yesterday.

And although right now we have not changed the latent debris in our calculations, we took the opportunity in the 2006 outage to clean up a lot of areas that we've never been able to get to before. And our latent debris when we calculated it post-2006 outage was down to 35 pounds.

CHAIRMAN WALLIS: That's pretty good. That's a bucket full.

MR. GASPER: Yes.

VICE CHAIRMAN BANERJEE: So are you trying to sharpen your pencil?

MR. GASPER: We're sharpening our pencil.

VICE CHAIRMAN BANERJEE: Why do you need to do it if you can eliminate the chemical effects? Can't you put enough area in just to handle the problem without penciling sharpening?

MR. GASPER: We're going into testing. I don't know the answer to that question yet.

VICE CHAIRMAN BANERJEE: You've got 5.3 feet now, right, rather than --

MR. GASPER: Yes. I think I am, but I'm still going to sharpen my pencil to the extent possible.

VICE CHAIRMAN BANERJEE: Well, it becomes harder to defend some of these things. I was looking to your CFD calculations, your transport. I mean, you can go on doing this stuff, but I mean it's not -- nothing like putting more area in. I mean, then you have --

CHAIRMAN WALLIS: But you haven't got much room to put it in.

VICE CHAIRMAN BANERJEE: Yes.

CHAIRMAN WALLIS: Anyway, let's continue.

VICE CHAIRMAN BANERJEE: Yes.

MR. GASPER: Yes. Yes, I mean that's the main driver is I don't have that much room to work with, and so --

CHAIRMAN WALLIS: We going to get the next, 36?

MR. GASPER: Yes. On 36 is just --

CHAIRMAN WALLIS: Because that's a pretty big zone of influence.

MR. GASPER: Yes. 17D ZOI is pretty big zone of influence. But it's an illustration that slides 36 and 37 are an illustration of the ZOIs that we're now using for the calculation --

CHAIRMAN WALLIS: It's very unlikely that a break in one steam line, one hot leg as I guess it's shown here, is going to effect the other steam generator on the opposite side of the containment. Isn't it very unlikely? Because there's walls in between. There's biological shield and stuff.

MR. CHOROMOKUS: Sure. As you heard yesterday, you can truncate that.

CHAIRMAN WALLIS: Right.

MR. GASPER: Yes.

CHAIRMAN WALLIS: So this is going to be certainly truncated quite a bit?

MR. GASPER: Right.

CHAIRMAN WALLIS: Okay.

VICE CHAIRMAN BANERJEE: In the upper regions above the wall, I guess, is what you're --

CHAIRMAN WALLIS: Is this goes outside the containment, too.

MR. GASPER: Yes. There's a wall in the way.

CHAIRMAN WALLIS: Okay.

MR. GASPER: Okay.

CHAIRMAN WALLIS: So it's a big amount of influence.

MR. GASPER: Yes. I'm going to skip, I'm moving head to slide 38.

CHAIRMAN WALLIS: Okay.

MR. GASPER: Two things we're taking

credit for. One is there clearly with the containment sprays inactivated, we're not having any washdown of the debris that goes in the upper --

CHAIRMAN WALLIS: This 25 percent was something magical from the EPRI -- from the NEI guidance?

MR. GASPER: Yes. It's from the NEI and the SER. We're going to be using a comparable method on zones of influence looking at the debris that's now transported into the upper areas of the containment. Expect something on the order of 70 percent will be probably transported to the upper areas of containment. Because we've got a large -- basically it's almost a chimney type of effect. You're going to blow debris up into the top of the containment. So we're looking to take credit for that.

One of the questions --

CHAIRMAN WALLIS: That's until you turn on any containment spray?

MR. GASPER: But we don't have sprays.

CHAIRMAN WALLIS: Never use it?

MR. GASPER: We're never going to use sprays in a LOCA situation.

CHAIRMAN WALLIS: So one of the areas of

commission of the operators would be to turn on the containment spray?

MR. GASPER: That's correct.

CHAIRMAN WALLIS: And that will be put into whatever kind of PRA or whatever you use for this?

MR. GASPER: Yes.

CHAIRMAN WALLIS: Yes.

MR. GASPER: I'm going to skip ahead in the interest of time, skip ahead to slide 40 and get into some of the recirculations.

MEMBER ABDEL-KHALIK: Now the implication of this, the containment fan cool units are safety grade equipment?

MR. GASPER: Yes. Yes. They have been from original design. Fort Calhoun was designed prior to the GDCs being issued. And the actual GDC at the time the plant was built was that you were required to have two redundant trains of containment sprays and two redundant trains of containment fan coolers. It was an early version of the interim GDC. I mean the plant was originally designed that way.

CHAIRMAN WALLIS: And the fan coolers aren't subject to water hammer during some of these--

MR. GASPER: We've gone through all that.

CHAIRMAN WALLIS: And they're not subject to water hammer during these --

MR. GASPER: Well, yes. We increased the over pressure in the tank to make sure that they were not subject to water hammer.

CHAIRMAN WALLIS: So you don't drain them and then refill them?

MR. GASPER: That's right. We had to --

CHAIRMAN WALLIS: You had to do that?

MR. GASPER: We had to make a modification to ensure that they weren't subject to water hammer.

CHAIRMAN WALLIS: Yes.

VICE CHAIRMAN BANERJEE: You're skipping slide 39, but it's an interesting slide. You are taking credit for dead areas in the flow and --

MR. GASPER: Well, no.

VICE CHAIRMAN BANERJEE: -- erosion --

MR. GASPER: The inactive zones are actually calculated to be 25 percent. But per the SER that was looked at, we're only crediting 15 percent inactive zone.

VICE CHAIRMAN BANERJEE: What do you

mean by inactive? Where the debris has fallen and there's no flow?

MR. GASPER: Below the reactor vessel.

VICE CHAIRMAN BANERJEE: Oh.

CHAIRMAN WALLIS: Below the reactor vessel.

MR. GASPER: Is roughly --

CHAIRMAN WALLIS: Noting happening. It's just a pool of stagnant --

MR. GASPER: Yes, it's a stagnate pool.

CHAIRMAN WALLIS: Yes.

MR. GASPER: And in addition we did plant specific testing on both the low density fiberglass and we've also done it on Cal-Sil for the erosion of large and small particles. Recognize now that with the flows we're calculating, we do not meet -- showing any tumbling now of the small or large pieces of insulation. We no longer show that.

VICE CHAIRMAN BANERJEE: Why is that? I mean, people with a larger containment yesterday found tumbling.

MR. GASPER: They had 5,000 and 9,000 gpm. We're talking about 450 pgm per train.

CHAIRMAN WALLIS: It's that low, is it?

MR. GASPER: 450 gpm run out low on the

high pressure injection pumps is maximum flow we're going to get.

CHAIRMAN WALLIS: And that's because you're not using the containment sprays?

MR. GASPER: We're not using the containment sprays anymore. So the problem on the CFD side, and I'm going to --

VICE CHAIRMAN BANERJEE: Why does anybody use these containment sprays then?

MR. GASPER: They're primarily -- well one is that we may be the only plant that has still retained the capability of having fully redundant containment fan coolers and containment sprays. I'm not sure if anybody else retained that.

Later plants, I believe, were not required to build to that criteria.

VICE CHAIRMAN BANERJEE: I see. That makes sense.

MR. GASPER: As a matter of fact, there were a number of plants that do not have safety grade containment plan coolers, later plants. So we may be relatively unique. I'm not certain.

Mike?

MR. SCOTT: Mike Scott, NRR.

I just wanted to mention to remind you

all, I think we mentioned this to you at the last meeting, that the Staff is encouraging an initiative to the industry to consider whether they can operate containment spray in other ways such as Fort Calhoun has done.

We have two pilot plants. Fort Calhoun is one of the pilot plants. D.C. C

CHAIRMAN WALLIS: Cook had intended to be pilot plant, but changed their mind. And I believe their discussions with Duke Power about their ice condenser plants to make one of them, and I can't remember which it is, another pilot plant.

So the Commission, and actually came from the previous Chairman, was very interested in the industry undertaking these type of reconsiderations. And we're still encouraging it. It's part of the holistic approach of considering -- you know, thinking outside the box so to speak of ways to address this issue.

So we have encouraged plants to come forward. I would not say that there has been a huge number of them coming forward yet. But they may be looking for how it comes out with these pilot plants to see if something works for them.

CHAIRMAN WALLIS: Interesting to see

what AP 1000 does with containment spray. I think that ACRS was instrumental in having it put in.

VICE CHAIRMAN BANERJEE: And now we'll be instrumental in having it taken out.

MR. SCOTT: I just wanted to mention that there is sort of an industry-wide discussion about this. And there may be other plants to go to it.

CHAIRMAN WALLIS: Okay. Thank you.

So let's move head.

MR. GASPER: Okay. On slide 40 --

CHAIRMAN WALLIS: Because these active zones we're going to come back when we see the CDF pictures?

MR. GASPER: Yes. On slide 40 if I just take the -- you know, on recirculation we'll have I said runout flow of around 450 gpm going through each train. If I simply take the open area of the strainer and then that gives me a velocity to the strainer of roughly .007 feet per second. And that's just dividing --

VICE CHAIRMAN BANERJEE: This is based on the open area?

MR. GASPER: That's just based on the open area of the strainer.

VICE CHAIRMAN BANERJEE: But not on the superficial area?

MR. GASPER: That is correct. I just looked at the open area, which would really be looking -- I'm more looking at the flow at the start of recirculation as what the flow in containment would be looking like.

One of the issues is when we briefed the Staff on this was the accuracy of the CFD model of these extremely low velocities. Particularly we did a low velocity flume test. Alion did the test for us.

VICE CHAIRMAN BANERJEE: But the low velocity is within the strainer itself? It's not necessarily that low outside the strainer? I mean in that region between the biological shield and the--

MR. GASPER: Well, we still --

VICE CHAIRMAN BANERJEE: What is the velocity in that region? It's not all that low?

MR. GASPER: Yes, it's still going to be very low because --

VICE CHAIRMAN BANERJEE: Well, you've cut everything by a factor of ten. So my last calculation was based on your --

MR. GASPER: But still I've only got 400 -- I mean with the calculation is basically running actually --

VICE CHAIRMAN BANERJEE: 450 gpm.

MR. GASPER: -- 450 gpm into that pipe in the containment. So I'm looking at flows in containment that would support --

VICE CHAIRMAN BANERJEE: That low flow?

MR. GASPER: -- that low flow.

VICE CHAIRMAN BANERJEE: Yes. Which is?

MR. GASPER: Which is going to be --

VICE CHAIRMAN BANERJEE: It's a matter of ten below the normal?

MR. GASPER: Yes.

CHAIRMAN WALLIS: Yes, but the flow pattern is much the same because the Reynolds number is huge.

MR. GASPER: Well, the Reynolds number is going to go down.

VICE CHAIRMAN BANERJEE: Well, it's now going to be about 10,000 --

CHAIRMAN WALLIS: Is it that low?

VICE CHAIRMAN BANERJEE: Well, maybe --

MR. GASPER: Yes. It's going to go down.

VICE CHAIRMAN BANERJEE: It's been ten

and 50, yes.

MR. GASPER: Yes. It's going to go down. It's a pretty low Reynolds number.

CHAIRMAN WALLIS: Okay.

VICE CHAIRMAN BANERJEE: But I think we can do this --

CHAIRMAN WALLIS: The Froude number is very small, too.

MR. GASPER: Yes.

CHAIRMAN WALLIS: It also is a factor.

VICE CHAIRMAN BANERJEE: So the thing that I noticed you also are using a better code, which actually does handle --

CHAIRMAN WALLIS: Can you describe this flume? This flume just seems to be a straight duct with a straight flow and you're confirming that it's uniform?

MR. GASPER: Yes. Well, that's what we're trying to do is -- what we were looking at was what's the ability of the CFD code to calculate a very low velocity situation. And basically --

CHAIRMAN WALLIS: That doesn't matter, does it?

MR. GASPER: Oh, yes. The question was raised by the Staff during our presentations. We did the test in response to the question raised by the staff.

We basically took --

CHAIRMAN WALLIS: Velocity is irrelevant though. It's Reynolds number or something like that that must --

VICE CHAIRMAN BANERJEE: It's all nondimensional.

CHAIRMAN WALLIS: Right.

VICE CHAIRMAN BANERJEE: Yes.

MR. GASPER: Well, as I get through it, we actually used the velocity when we got into how we did the transport.

CHAIRMAN WALLIS: Okay. Something is strange here. Are you going to explain it to me? You have a square duct and you have 16 readings of velocity in it?

MR. GASPER: Yes. The readings were taken at those locations using a --

CHAIRMAN WALLIS: Now what is 45? Can we go to 45 and you can tell us what the numbers on slide 45?

MR. GASPER: Slide 45. The upper number was using an ultrasonic low flow meter.

CHAIRMAN WALLIS: Is that the flow rate

in that box or the --

MR. GASPER: Yes. It's at that point.

CHAIRMAN WALLIS: What? The flow rate? Is gpm in that node? Is that --

MR. GASPER: Yes. We put the --

CHAIRMAN WALLIS: That's right. You're right. I mean, you can't be right because you've got 17 gpm at zero feet per second.

MR. GASPER: Okay, wait. Can I go ahead?

CHAIRMAN WALLIS: Yes, please.

MR. GASPER: The upper one is the flow is measured by the ultrasonic flow meter. The bottom one was by the ADV, which --

CHAIRMAN WALLIS: Doplar?

MR. GASPER: Which was the acoustic doplar velocifer.

CHAIRMAN WALLIS: They don't seem to be consistent.

MR. GASPER: So --

CHAIRMAN WALLIS: If there's no velocity, there can't presumably be a flow rate.

MR. GASPER: Well, they were within --

CHAIRMAN WALLIS: It doesn't make sense somehow.

MR. GASPER: That's what was measured by the instruments --

CHAIRMAN WALLIS: It doesn't make sense.

MR. GASPER: with the slow regimes --

CHAIRMAN WALLIS: Look at the top left hand corner, 16.7 gpm at zero feet per second. It doesn't make any sense.

MR. CHOROMOKUS: I think what's important is that we were trying to make the velocity--

CHAIRMAN WALLIS: What you were trying to do, it doesn't really matter. They're saying what you got.

MR. CHOROMOKUS: What we got, correct.

VICE CHAIRMAN BANERJEE: What you've got with the gpm is almost uniform.

CHAIRMAN WALLIS: And the velocities don't make any sense.

VICE CHAIRMAN BANERJEE: Yes.

MR. CHOROMOKUS: The flow velocities don't make sense?

VICE CHAIRMAN BANERJEE: Well, maybe the velocities make sense and gpms don't.

CHAIRMAN WALLIS: No. It doesn't make sense to have no velocity.

MR. GASPER: Well, we were off scale low.

VICE CHAIRMAN BANERJEE: Yes.

MR. GASPER: I mean I guess the other way to look at that is we were off scale low. It wasn't necessarily low, but we were off scale low on the --

VICE CHAIRMAN BANERJEE: So your measurements are of no importance here?

MR. GASPER: Well, there were two key things that I think came out of that. Was that the bulk flow of velocity calculated by the CFD and what was measured by the ultrasonic flow meter, we did use one in bulk was within three tenths of a percent. We did measure the local velocity at the center of the flume in the measurement that is shown, and that that was within .004 feet per second. It was slightly higher.

The local velocities predicted by the CFD analysis near the floor of the pool, which is four inches off the bottom of the -- or an inch off the bottom of flume is approximately .17 feet per second higher than what was seen during the testing.

So basically we concluded that the--

CHAIRMAN WALLIS: It's a tremendous

error, though because the velocity you're measuring is at the same order, isn't it?

VICE CHAIRMAN BANERJEE: But I don't think this is worth really --

CHAIRMAN WALLIS: I don't think it's worth --

VICE CHAIRMAN BANERJEE: Yes.

CHAIRMAN WALLIS: I mean I don't think it's worth spending time on.

VICE CHAIRMAN BANERJEE: The measurements are not accurate and this doesn't prove or disprove anything.

CHAIRMAN WALLIS: And it's not a very useful experiment, probably.

VICE CHAIRMAN BANERJEE: Yes.

CHAIRMAN WALLIS: So shall we just skip over it?

MR. GASPER: Basically we concluded that slide 47 was a CFD model is capable of predicting low velocities not less than .01 feet per second.

CHAIRMAN WALLIS: Well, this is something really strange about this.

VICE CHAIRMAN BANERJEE: Is it necessary for you to have all this stuff? I mean --

MR. GASPER: This was something that was

asked --

VICE CHAIRMAN BANERJEE: -- you came up with a nice way to handle the problem and you're not just going to make everybody cross.

CHAIRMAN WALLIS: Well, velocity has nothing to do with it. You know, forget it. Forget it. Because this just doesn't convince me of anything.

VICE CHAIRMAN BANERJEE: Yes.

MR. GASPER: Okay.

CHAIRMAN WALLIS: Why did the Staff make you do something so inappropriate?

VICE CHAIRMAN BANERJEE: They were worried about the code. You don't have to defend it.

CHAIRMAN WALLIS: We'll have a private meeting with you.

It just seems very odd.

VICE CHAIRMAN BANERJEE: All this stuff is very iffy.

CHAIRMAN WALLIS: But anyway, the next picture. The pictures look pretty, don't they?

MR. GASPER: Right. On slide 48.

CHAIRMAN WALLIS: Well, I was concerned about these things you call stagnant regions. Are you going to get credit for these regions?

MR. GASPER: Okay. Let me go ahead. On slide 48 we introduced mass-less particles in the CFD calculations to visualize the flows. So this was an attempt to look at what does a flow look like at this -- this was actually done at 1350 gpm recirculation. And it was done to visualize the flows.

You can see the flow pattern as a break in the alpha steam generator bay. You turn to slide 48, these are the regions that we calculated -- or slide 40, excuse me. Sorry.

Slide 49 shows the regions that we calculated the velocity was equal to or greater than 0.1 feet second.

CHAIRMAN WALLIS: Why is the flow around the reactor?

MR. GASPER: It's isolated. Well --

CHAIRMAN WALLIS: It just seems to be inconsistent. It's going --

MR. GASPER: It's in that --

CHAIRMAN WALLIS: -- clockwise and anti-clockwise at the same time.

MR. GASPER: We're basically in a totally stagnant region right there.

CHAIRMAN WALLIS: Well, I would think so, but it's got arrows in there.

VICE CHAIRMAN BANERJEE: But these arrows are they indicative of velocity? Are they vectorial or --

MR. GASPER: They're vectorial, but you're right at the --

VICE CHAIRMAN BANERJEE: Well in that case --

CHAIRMAN WALLIS: It doesn't make any sense.

VICE CHAIRMAN BANERJEE: -- -- of mass.

MR. GASPER: Yes.

CHAIRMAN WALLIS: There must be an upwards flow or something. They're at all the same length, so they don't tell you anything about the actual velocity itself.

VICE CHAIRMAN BANERJEE: Are you hanging anything on this stuff?

MR. GASPER: Yes. Let me go. Yes.

VICE CHAIRMAN BANERJEE: You do? Well, then we'd better look at it in more detail.

MR. GASPER: This is the velocity -- this is from a three dimensional model. This is the velocity's one inch off the floor.

VICE CHAIRMAN BANERJEE: What will you use this to claim.

MR. GASPER: Let me keep going.

VICE CHAIRMAN BANERJEE: Okay.

MR. GASPER: Okay. This is the velocity fields one inch off the floor. We looked at total kinetic energies required to suspend individual fibers. We determined that that's probably nonconservative, and so that we in order to look at the amount of fine debris that would be transported from a break in the steam generator A, we used the relative percentage of the square footage of the containment that is red. So that we ended up saying that for steam generator A we would basically transport 72 percent of the fine debris. We assumed that the fine debris was initially uniformly distributed across the floor. And that rather than using total kinetic energy, we ended up using the percentage of the floor that was showing velocities greater than or equal to .01 feet per second.

CHAIRMAN WALLIS: Is the velocity a certain distance above the floor?

MR. GASPER: One inch.

CHAIRMAN WALLIS: Did you look at the overall flow pattern?

MR. GASPER: Yes.

CHAIRMAN WALLIS: You seem to have such flow which is only going into one deadend and never coming out.

MR. GASPER: This is the bottom node of the --

CHAIRMAN WALLIS: But at some other level there's going to be a difference?

MR. GASPER: -- on a 3D -- yes. It's a 3D pool.

CHAIRMAN WALLIS: Okay.

MR. GASPER: This is the bottom node on a 3D pool.

VICE CHAIRMAN BANERJEE: But you told us that the only inactive areas you considered were below the reactor vessel or something, was only 15 percent, right?

MR. GASPER: Well, that was an inactive area that we didn't consider any transport from.

VICE CHAIRMAN BANERJEE: Right.

MR. GASPER: We then were left the problem of the only debris that we now have enough energy to transport is basically fine debris.

VICE CHAIRMAN BANERJEE: Right.

MR. GASPER: And when we ran the total

kinetic energy calculations, that appears to be nonconservative. Because we then drop back and said we're going to transport the debris for the area that had a velocity greater than or equal to 0.1 feet per second as a conservatism. So that's where the debris transport --

VICE CHAIRMAN BANERJEE: I'm trying to understand what is going into the calculations actually. Are you actually relying on these red and blue diagrams to tell you something useful.

MR. GASPER: That's when we go to the transport tress, that's the percentage of fine debris that we transport to the surface of the strainer.

CHAIRMAN WALLIS: That you take credit then for this?

MR. GASPER: Yes.

CHAIRMAN WALLIS: And this is 1350 gpm, but now you're only counting 450?

MR. GASPER: Well, actually you had both. We had three pumps on both -- on full.

CHAIRMAN WALLIS: Now you're only going to use one?

MR. GASPER: One per train. So this is conservative.

CHAIRMAN WALLIS: So you're going to scale it down to 450?

MR. GASPER: Well, no. We're probably going to use this as a conservative value.

CHAIRMAN WALLIS: -- and the flow pattern isn't going to change much, is it?

MR. GASPER: No, but it's just --

CHAIRMAN WALLIS: Presumably.

MR. GASPER: -- if the velocities are going to go down again.

VICE CHAIRMAN BANERJEE: So how much credit are you claiming? I mean, is it significant or insignificant?

MR. GASPER: We're using this as our basis for our transport fraction to the strainer.

CHAIRMAN WALLIS: So is it all one?

VICE CHAIRMAN BANERJEE: So you can't live with saying all the stuff is just transported to the strainer? I mean you can't just get saying everything generated --

MR. GASPER: Well, you could, but I --

CHAIRMAN WALLIS: You don't want to?

MR. GASPER: I don't want to.

CHAIRMAN WALLIS: What happens if you do? Is the number much bigger?

VICE CHAIRMAN BANERJEE: How much bigger would that?

MR. GASPER: Well, it's roughly a 25 percent reduction in the amount of material, a 30 percent reduction in the amount of material.

VICE CHAIRMAN BANERJEE: Of fines?

MR. GASPER: Of fines. Nothing else transports.

VICE CHAIRMAN BANERJEE: Fines and fibers.

CHAIRMAN WALLIS: Well, probably your turbine's smaller, could be an error by that much, couldn't it?

VICE CHAIRMAN BANERJEE: Yes. But it's not a huge reduction. There's uncertainties in the amount that you're generating anyway.

MR. GASPER: Yes.

VICE CHAIRMAN BANERJEE: But taking that into account, you're saying 75 percent of the fines and the fibers get to the strainers. Not a 100 percent.

MR. GASPER: Yes.

CHAIRMAN WALLIS: But the testing is done in a stirred tank assuming everything gets there, isn't it? How does the testing relate for this sort of a model?

MR. GASPER: We're still working on the testing. It's not clear -- okay. It is not clear to me that clearly we are transporting something on the order of .01 feet per second. We're actually running less than that. It's not clear to me that stirring is necessarily appropriate for this very low velocities that we're going to be seeing.

VICE CHAIRMAN BANERJEE: You'd have to show this -- you know, these diagrams don't tell you very much because they're just red and blue. So: (1) you don't have any idea of what the real velocities are when they are read, for example.

MR. GASPER: Well, we can only -- remember, the CFD is good down to .01 feet per second.

CHAIRMAN WALLIS: It's good down to less than that.

MR. GASPER: According to our testing we're not confident that it is. That's about --

CHAIRMAN WALLIS: There's nothing magic about a certain velocity.

VICE CHAIRMAN BANERJEE: And your testing is not reliable anyway. I mean, you get different data from probes. I wouldn't put too much credence from that test.

CHAIRMAN WALLIS: Well, the Staff is going to decide how much credence to put on it.

VICE CHAIRMAN BANERJEE: Right. But you get two different readings from two different instruments, right?

MR. GASPER: Now you may --

VICE CHAIRMAN BANERJEE: So how do you know which is right?

CHAIRMAN WALLIS: Well, I think we've raised enough questions.

MR. GASPER: I don't think we necessarily get two different readings.

CHAIRMAN WALLIS: I know if we're going to ever see you again, but next time you'll have better answers. I don't know what the process is here from now on. It's very interesting to learn what you folks are doing.

MR. GASPER: Basically on slides 54 and 55 we now are showing what our debris loads --

CHAIRMAN WALLIS: Now are?

MR. GASPER: -- are now are.

CHAIRMAN WALLIS: Yes.

MR. GASPER: You see, we've considerably reduced the debris.

CHAIRMAN WALLIS: This is with the 450?

MR. GASPER: This is actually with the 1350.

CHAIRMAN WALLIS: Why are you up to 1350 still?

MR. GASPER: Well, 1350 was with the three high pressure injection pumps. These are preliminary data that we're still rerunning the cases just for the 900.

CHAIRMAN WALLIS: Okay.

VICE CHAIRMAN BANERJEE: These are not data, they're calculations, I take it, right?

CHAIRMAN WALLIS: These are calculations.

MR. GASPER: It's calculations, Yes.

CHAIRMAN WALLIS: Yes.

And it's probably wise to put some conservatism on top of this because of the doubts about some of the calculations? You want to be sure this thing will work, don't you? As an engineer you want to be sure it'll work. So these presumably are either conservative already or you want to put some conservatism on top of that?

MR. GASPER: And we believe there is conservatism in it. We're basically following again the 04-07 guidance, and there's conservatism built into that guidance.

MR. CHOROMOKUS: A double-ended guillotine break.

MR. GASPER: Plus a double-ended guillotine break, yes.

CHAIRMAN WALLIS: Sort of unlikely, let's say.

Okay. So we're almost to the end. And you're going to finish on time.

MR. GASPER: I'm trying.

So just kind of moving ahead to slide 56. Plans right now are to go ahead with head loss testing conducted with some type of a mock up of the containment flow paths predicted by the CFD analysis. We will be using a conservatively high flow. We anticipate that we will be seeing near field effects because we are probably transporting more material to the strainer than physically can be transported. And we're just in the mode right now of generating the test plan for the test that we'll start in mid-June.

CHAIRMAN WALLIS: So you've put in these two new strainers and your plan is to show that they will work?

MR. GASPER: That's our hope.

CHAIRMAN WALLIS: But you have no plan to put in anymore strainers or anything like that?

MR. GASPER: We will put in whatever is required based on the testing. I said we hope that the existing strainers will be adequate.

CHAIRMAN WALLIS: So you could put in a bigger strainer?

MR. GASPER: Yes. Yes.

VICE CHAIRMAN BANERJEE: You could make this box a bit bigger?

MR. GASPER: Yes. Or we could add another module.

VICE CHAIRMAN BANERJEE: You could add another module.

MR. GASPER: The straightforward thing is to add another module.

VICE CHAIRMAN BANERJEE: The near field effect credits that you're taking, hopefully, are very small or none at all. Because it's very hard to trust these codes, I will say. Not in terms of transport of particles and drop out of particles, it's extremely to give any credit with reliability based on these.

Settling of materials in a turbulent

flow are very poorly understood.

MR. GASPER: Understand.

VICE CHAIRMAN BANERJEE: Yes.

MR. GASPER: Again, the calculations are strictly being done to determine water velocities.

VICE CHAIRMAN BANERJEE: Yes. But once you've determined the water velocities to actually give credit for drop out from that I think is an extreme measure.

CHAIRMAN WALLIS: It might be cheaper just to put in another strainer.

VICE CHAIRMAN BANERJEE: Yes.

CHAIRMAN WALLIS: And not try to justify all these things by a lot more experiments. But anyway, it's up to you guys to decide.

DR. LU: This is Shanlai Lu for NRR Staff.

Regarding the credit in near field settlement, I think we have already given our position back almost one year ago. Anybody wants to take credit, you needed to provide the testing protocols and the proper scheme methodology and submit it to the Staff for review before you conduct the test. However, we still believe that it's a physical phenomena itself. You have the debris close to the strainer. You have a conglomeration and the gravity works.

But if you really want to do that in the proper testing protocols, it needs to be submitted.

MR. GASPER: Yes. We met with the Staff February 2006 or something like that.

MR. LU: That's right.

MR. GASPER: And we went over our methodology I know.

MR. LU: That's right. That's the reason we are looking for the document for review.

MR. GASPER: Yes.

VICE CHAIRMAN BANERJEE: And my suggestion was that CFD codes won't tell you very much about this. I mean, experiments are always good provided they're done right.

MR. GASPER: And I think that we're at the point --

VICE CHAIRMAN BANERJEE: Yes, that's quite a trick though, sometimes.

MR. GASPER: And finally on slide 57 relative to chemical effects, I said we're really looking at two possibilities on our chemical testing. One is to use the WCAP methodology using that in generating. The second is that I think Rob later today will be discussing a 30 day Alion, a test Alion is putting together. And we're also looking at that as a methodology to handle chemical effects.

VICE CHAIRMAN BANERJEE: I thought you had eliminated or were planning to eliminate chemical effects?

MR. GASPER: If we do chemical testing. As I said, we have two options to do. One is to eliminate it and one is to test. And it's an economic decision at that point.

CHAIRMAN WALLIS: Are you going to downstream.

MR. GASPER: And then downstream we're going to be collecting and sizing with the SEM standard stuff. We will also be doing a test that would actually maximize the bypass so that we minimize the amount of hangup of the debris that hangs up. You know, basically it's a minimum debris -- fiber alone. So we will run a test to do that.

So I think the biggest change from what the rest of the industry is doing, obviously, is that we're now going back to a mode where we're minimizing recirculation flows and using that as an approach to resolve GSI-191.

CHAIRMAN WALLIS: But your conclusion really is that water management is the way to go for you?

MR. GASPER: Yes, water management is the way to go for us.

CHAIRMAN WALLIS: Right.

MR. GASPER: So it's a kind of an opposite side of the spectrum from Salem where you put in a very large strainer.

CHAIRMAN WALLIS: Since we've had these discussions about CFD with both of these presentations, it may be appropriate for the Staff sometime to explain to us what their acceptance criteria are going to be for these CFD models and the associated debris transport. Because it's the Staff's got to decide whether or not they're going to accept credit or what's predicted by the CFD models.

MR. GASPER: There is a pretty good discussion of that, I believe, in 07 --

CHAIRMAN WALLIS: We don't know what the Staff's basis for deciding is.

MR. GASPER: Yes. In 04-07 SER discusses the criteria if you're going to use CFD.

CHAIRMAN WALLIS: Yes.

MR. SCOTT: Dr. Wallis, Mike Scott.

You may recall that what I told you yesterday morning is we're planning to come back in the fall. And at that time we're going to have draft review guidance for the ares that we don't already have review guidance. So that would probably be a convenient time to discuss that.

CHAIRMAN WALLIS: Very good. It would be very good.

Yes?

MEMBER ABDEL-KHALIK: I understand that you may be in a unique position inasmuch as you have safety grade containment all units. I must admit that I'm still sort of concerned about the idea of eliminating automatic initiation of containment spray without seeing the detail results of your analysis.

CHAIRMAN WALLIS: Yes?

MR. GASPER: I think there is a trade off there, but the trade off is clearly in the direction overall from a safety perspective of reducing core damage frequency by substantially increasing the length of that injection phase.

MEMBER ABDEL-KHALIK: That may be true, but I'd like to see the results of the mechanistic calculation.

MR. GASPER: Okay.

MEMBER ABDEL-KHALIK: The deterministic calculation.

MR. GASPER: Actually, from our containment pressure calculations I can visit with you on the side. But the peaks are turned very early by the overall absorption of heat and the mass of metal in containment.

CHAIRMAN WALLIS: These are GOTHIC predictions, is that what it is?

MR. GASPER: What?

CHAIRMAN WALLIS: These are GOTHIC?

MR. GASPER: Yes. These are all GOTHIC calculations. Yes.

MEMBER ABDEL-KHALIK: It may seem that changing emergency operating procedures to allow early initiation of containment flooding might be a better option.

MR. GASPER: Well, that takes us beyond design basis is part of our -- that is clearly in our procedure --

MEMBER ABDEL-KHALIK: Without seeing the detailed results, I really --

CHAIRMAN WALLIS: So these fan coolers

are run with electric power?

MR. GASPER: Yes.

CHAIRMAN WALLIS: So if you had a LOCA loops simultaneously, loss of off site power --

MR. GASPER: They're loaded on the diesels.

CHAIRMAN WALLIS: Then the diesels have enough to handle them?

MR. GASPER: Actually, with taking it off containment spray pumps it conservatively unloads our diesels, yes.

CHAIRMAN WALLIS: Okay.

MR. GASPER: Unloads our diesels.

CHAIRMAN WALLIS: Any questions from the Committee. We've now reached the appropriate time for finishing. Does the Staff want to make a statement?

MR. LEHNING: Just one brief comment, Dr. Wallis, on the CFD reviews that the Staff does.

This is John Lehning of the NRR Staff.

Some of the audit reports that are publicly available right now have examples of reviews that we have done. And one is San Onfre that was recently put on our webpage if you're interested.

CHAIRMAN WALLIS: It's just a question of how much time we have to read all these audit reports now. Yes. Thank you very much.

Anything else from the Committee or from--

VICE CHAIRMAN BANERJEE: But I think Mike's idea of actually doing this in a fall meeting, just updating us about what CFD is acceptable to the Staff and things like that would be useful.

CHAIRMAN WALLIS: Yes.

VICE CHAIRMAN BANERJEE: You know, we haven't really caught up with this for a while.

CHAIRMAN WALLIS: And once we know that the Staff is doing the right thing, we can drop the issue, right?

MEMBER ABDEL-KHALIK: I assumed that at some time you'll come back to us and explain how your experimental methodology and choice of both --

CHAIRMAN WALLIS: I don't know what the plan is whether we'll ever see these folks again.

MEMBER ABDEL-KHALIK: -- test program actually is truly representative of the actual system, how you went through this scaling process.

MR. LARSON: We'll provide all those

documents to the Staff, and it will then be provided to you.

CHAIRMAN WALLIS: Yes, the Staff will see this again. I don't know if we will see it again.

MR. LARSON: I'll also make sure I understand the question after this that I wrote down so that I can make sure that I do answer it. But we are providing all the documents to NRC.

CHAIRMAN WALLIS: Mike Scott.

MR. SCOTT: I don't think we'd assumed that these licensees would come back for another round like this one. I would say if there is a specific subject, perhaps what you raised or something else, that maybe we could have somebody come back.

CHAIRMAN WALLIS: Isn't how we handle it? If we had concerns about how you were approving some application from some licensee, we might want to dig into it. But I guess we can always do that by looking at your SER.

MR. SCOTT: Right. Well, SER on the topical reports, is that what you're --

CHAIRMAN WALLIS: How do you actually sign off on what they're doing here? Don't you give them an SER?

MR. SCOTT: No. It's not an SER.

CHAIRMAN WALLIS: Whatever it is.

MR. SCOTT: It could be. I mean, the process allows for an SER. But what we plan to do is once we get the generic letter responses in and have decided that they're adequate, we will send each plant a close out letter.

CHAIRMAN WALLIS: Is it a one page letter or is it an analysis that you send them back?

MR. SCOTT: Well, the exact form is not yet decided.

CHAIRMAN WALLIS: Because a one page letter we have no idea of the basis of your decision.

MR. SCOTT: Well, we will have a basis for our decision.

CHAIRMAN WALLIS: Will we know what it is?

MR. SCOTT: Yes, certainly.

CHAIRMAN WALLIS: Okay.

MR. SCOTT: We don't plan to keep it secret.

CHAIRMAN WALLIS: Maybe on that note, it's time to take a break, is it? Take a break until quarter to 11:00 and then we will start Wolf Creek.

(Whereupon, at 10:36 a.m. a recess until 10:52 a.m.)

CHAIRMAN WALLIS: Okay. Let's start again.

We have another one of these interesting case studies. This time from Wolf Creek, and we're looking forward to it. So please go ahead.

MR. DINGLER: I'm Mo Dingler, I'm from Wolf Creek and Chris Kudla from PSI and Tim. You know Tim from Westinghouse.

We were going to have Stu Cain from Alden Labs with us. Monday he -- I don't know if he got nervous or not, but he had to go into the hospital for tests unexpectedly. So Chris talked to him Monday afternoon, nothing happened. I got a call yesterday and Monday night late they put him in the hospital for testing. So if you get into a lot of questions on our testing and proposed testing, Stu was going to be here and we may have to defer our --

VICE CHAIRMAN BANERJEE: He's from Alden Labs?

MR. DINGLER: He's from Alden Labs, yes.

What I want to do is give you a little history of what we've got done and where we're going, like everybody else did and then go into our design. And we took some approaches like Joe Omaha took water management, we took of doing some testing at Wyle Labs to reduce some of our debris and stuff like that. So we'll get into that.

Our original conditions were large dry containment. We're a high fiber plant like Salem. We mostly got Nukon insulation.

CHAIRMAN WALLIS: How many truck loads?

MR. DINGLER: I got that for you, on that.

Our pre-GSI-191 sump is approximately 400 square feet. I'll get to how much we're putting in.

Our management as we started this program, as Dr. Wallis said, the design, you need to know where we're going. Well, our management gave us some criteria of going on for our sumps too before we had any idea how big. They wanted to utilize the existing sump area. They want to minimize loss of containment floor. And they wanted to maximize the new sump surface area. So they gave us those overarching criteria for us on that.

Next slide. What I'm going to do is show you some pictures of that of what we installed. Our new strainers, we have two train operation at about 6600 square feet total or about 3300 square feet for each train.

Our perforated hole size is 0.045 inches. I think we went very small because we were aware that the large sump screens we might have bypass, so we went in with the smallest opening that they could fabricate real easily on that.

Based on that our approach velocity based on the surface area of the screen is 00.6 feet per second at the screen itself. And we'll show you--

CHAIRMAN WALLIS: CFD can't predict that.

MR. DINGLER: And right, we're not showing CFD on that. But it shows you how compaction -- on our testing that there's no compaction of the fiber and stuff like that. So we'll show you. We didn't use CFD for that.

Next slide.

There's the installation of our sump installed or let's say not installed, but let's built into the factory. We wanted to make sure when we put it in containment that we could do it relatively easy due to dose and time concerns. So we built it there in the factory. You can see the man there. It's approximately 10 foot high, eight by eight.

CHAIRMAN WALLIS: Now the next picture shows it goes into a hole in the floor?

MR. DINGLER: The next picture it goes in a hole in the floor.

CHAIRMAN WALLIS: Doesn't the hole get covered with debris then?

MR. DINGLER: Yes, and we'll show you why that approach velocity --

CHAIRMAN WALLIS: The debris comes from above?

MR. DINGLER: The debris come from above.

CHAIRMAN WALLIS: And it has to somehow get down the sides of this thing?

MR. DINGLER: That's correct. And we'll show you pictures of the testing that shows that. We actually tested a flume in a pit.

VICE CHAIRMAN BANERJEE: You're going to show us pictures of the details of this? The plates and --

MR. DINGLER: Yes. In other words, we have some that shows actually in the flume, actually show you some more details of that.

CHAIRMAN WALLIS: Well, this is something like 10 by 10 by 10 or something, the whole thing?

MR. DINGLER: The modules are two by two.

CHAIRMAN WALLIS: So the whole thing is two by two and there are four of them?

MR. DINGLER: There's four of them.

CHAIRMAN WALLIS: Right.

MR. DINGLER: It fits in a pit eight by eight by eight.

CHAIRMAN WALLIS: Eight by eight by eight the pit?

MR. DINGLER: Yes.

CHAIRMAN WALLIS: So the modules are somewhat less than two feet?

MR. DINGLER: Somewhat less, yes.

CHAIRMAN WALLIS: Yes.

MR. DINGLER: Then all our piping comes in the bottom of our pit with vortex -- anti-vortex device on our piping and stuff like that.

What we wanted to do is what everybody

else did, is show you that we evaluated and we divided our evaluations into independent tasks. And I'll give a little of those, each one of those.

Accident characteristics and debris generation was one area we did. And we took debris transport including upstream reviews. Then we'd look at what we transported and that, and looked at debris head loss, bypass testing and chemical effects. And you'll see there that we did some testing with what we thought was a good chemical. We found out that was nonconservative, so we're in the process of doing some retesting.

Our downstream evaluations you heard yesterday. We're looking at blockage and wear and then long term cooling. And that's ongoing at this point right now. We did Rev. 0 and we'll have to do Rev. 1, review that again.

Next slide.

Some of these break locations just to give you an idea, this slide and the next slides gives you the break locations we looked at. But we wanted to look at the breaks with the largest potential of debris, a break with two or more different types of debris, a break with a direct path to the sump. And you can see what we did about that one. We eliminated that one break on us on there. And I'll show you a picture of what we did. Large breaks with the largest potential of particulate to fiber and the breaks that could generate a thin bed an eighth of an inch thick.

Next slide.

Our sump is in the area, about the 3 o'clock. This is an upper view. It's under those two round areas. Those are accumulators on there.

CHAIRMAN WALLIS: So you're going to show us, and my colleagues asked for the details of the strainer design.

MR. DINGLER: Yes, it's on back in--

CHAIRMAN WALLIS: It's coming later, is it?

MR. DINGLER: It's coming later.

CHAIRMAN WALLIS: I'm sorry. I don't see it.

MR. DINGLER: That just slows you the locations of the sumps in that.

VICE CHAIRMAN BANERJEE: Where is the sump?

MR. DINGLER: The sump's at 3 o'clock below those accumulators, those round bubbles. This is an upper view.

VICE CHAIRMAN BANERJEE: Nine and 3 or?

MR. DINGLER: No. They're 3 o'clock. They're both 3 o'clock.

CHAIRMAN WALLIS: So it's not show here?

MR. DINGLER: Not shown there.

CHAIRMAN WALLIS: It's something like that hole in the floor though?

MR. DINGLER: It's a hole in the floor on the base slab. There's two of them right together.

VICE CHAIRMAN BANERJEE: There seems to be a sort of a symmetric arrangement here?

MR. DINGLER: Yes, there is. This is a four loop, new four loop --

CHAIRMAN WALLIS: And there's a pressurizer somewhere? Well, that's this --

MR. DINGLER: The pressurizer is at about --

PARTICIPANT: Seven o'clock.

CHAIRMAN WALLIS: Seven o'clock. That's what, 7:30.

MR. DINGLER: Yes, 7 o'clock.

CHAIRMAN WALLIS: It's on there. That's the pressurizer.

MR. DINGLER: I'm sorry. Nine o'clock

was the sump. It's at 9 o'clock.

VICE CHAIRMAN BANERJEE: Nine o'clock.

MR. DINGLER: Nine o'clock.

VICE CHAIRMAN BANERJEE: So it would be nine or three?

MR. DINGLER: Yes, it could ge 9:00 or 3:00, whichever way you want.

Our zone of influence, the next slide, we used what was recommended in the SE and the NEI report, except for the coatings. We used the 5 L/D encoatings. We did some testing on that one.

What we did after we did the testing on that, we looked at what kind of margins we wanted, what kind of comfort factor we wanted to go in to do additional testing. So currently we're doing refined evaluations at this point, which is to reduce the programmatic insulation we have. Nukon is a big contributor. And we found that Min-K was also a contributor to our --

CHAIRMAN WALLIS: The reduction of 17 L/D to 5 L/D is an enormous reduction in pressure, isn't it?

MR. DINGLER: That's right. And we'll show you the pictures of what we tested on that one. We actually went in and tested at 13 L/D for Nukon, 10 L/D, 6 L/D and 5 L/D

VICE CHAIRMAN BANERJEE: This is all jacketed?

MR. DINGLER: That's all stainless steel jacket over with three latches, a whole in each jacket.

CHAIRMAN WALLIS: With a jet coming out aimed at the Nukon?

MR. DINGLER: That is correct. We went with a two-phased jet and we'll show you a movie of that two-phased flow coming up.

CHAIRMAN WALLIS: Okay.

MR. DINGLER: Min-K we have stainless steel welded encapsulation around the Min-K. And we actually tested those to actual plant installed conditions to show that the stainless steel welded to jackets did not lose the --

CHAIRMAN WALLIS: So nothing happening?

MR. DINGLER: Nothing happened to the Min-K.

And Salem said --

CHAIRMAN WALLIS: Coming down from 28.6 L/D to nothing?

MR. DINGLER: To nothing.

Salem yesterday said that this Min-K is

in our areas that have high dose right next to the reactor vessel and in our areas what we call the wagon wheels coming out with the piping out of our vessel that has a gap of probably 3/8th of an inch or so gap. We have to insulate between the support and the concrete.

VICE CHAIRMAN BANERJEE: What is WC insulation?

MR. DINGLER: Wolf Creek.

Next slide.

This shows you a drawing of use for Nukon 17 L/D. It covers quite a bit of the area. And if we reduce it down to 7 L/D what the reduction in that sphere would be. We're pretty well open containment, so a reduction in that is quite significant for us on that.

Right now we're still evaluating. We tested down to 5 L/D. I had 7 L/D data, so I used 7 L/D. We're looking at using potentially 8 L/D for our evaluations. That's still ongoing.

Now the next slide is debris transport including upstream reviews. We had a lot discussion on the CFD model to simulate flow patterns during recirc. There'll be a lot of discussion on that one as we go forward. But the key is, remember the one zone of breaks that we had to look at to get the largest or the debris -- or the break close to the sump. We went ahead and installed barriers close to our openings and the bioshield is right next to the sump. So it forced the water away from it.

CHAIRMAN WALLIS: And do you take some credit for those barriers?

MR. DINGLER: The barriers are installed for zero debris on that.

VICE CHAIRMAN BANERJEE: The barriers just divert the flow?

MR. DINGLER: They divert the flow which diverts the debris and stuff like that. Go to the next slide.

CHAIRMAN WALLIS: And the CFD gives you some credit as a result of that?

MR. DINGLER: No. The CFD just shows us the velocity when we force the flow on a long path.

MR. DINGLER:

So do you get any benefit from the barriers?

MR. DINGLER: The barriers is we don't have that debris -- that break right close to that sump and get instantaneous loading with the sump.

There are the sumps at the 9 'clock, the two square openings, there, that area is the sumps.

The area right up next to it going off of the upper sump, going off of the upper corner is one of the openings that we plugged up. We put a barrier on in there. You can see all the water now goes out to the other side and forces around.

CHAIRMAN WALLIS: I'm very puzzled here. Everything looks symmetrical. Where does it go out? Where's the sump.

MR. DINGLER: In other words, the sumps on the --

VICE CHAIRMAN BANERJEE: These two square--

MR. DINGLER: The two square areas.

VICE CHAIRMAN BANERJEE: These two rectangular --

CHAIRMAN WALLIS: Those rectangular things are the sump?

MR. DINGLER: Those are the sumps.

VICE CHAIRMAN BANERJEE: You can see the arrows --

CHAIRMAN WALLIS: The flow seems to be going around them.

VICE CHAIRMAN BANERJEE: Some of it, but some goes into it.

MR. DINGLER: We have a six inch curb

around them, too. So some of the 6 inch curb will force some of the flow around.

CHAIRMAN WALLIS: Some of it seems to be just going, running, flowing along the side without going in at all. It seems rather strange this stuff up here. It's racing around.

VICE CHAIRMAN BANERJEE: Well, the sumps probably have fairly high resistance to taking -- how did you model the sumps?

MR. DINGLER: We did model the sumps. We showed the water coming to the sumps and we didn't model the sumps in --

VICE CHAIRMAN BANERJEE: So you've made some assumptions about how much water uptake the sumps will have?

MR. DINGLER: That's correct.

VICE CHAIRMAN BANERJEE: And just distributed it uniformly or something?

MR. DINGLER: For our CFD?

VICE CHAIRMAN BANERJEE: Yes.

MR. DINGLER: To get velocities, yes. Because we didn't want to take credit --

CHAIRMAN WALLIS: Where is the break here?

MR. DINGLER: The break is anywhere

inside the bioshield, the gray shield.

CHAIRMAN WALLIS: Anywhere inside?

MR. DINGLER: Anywhere in there.

CHAIRMAN WALLIS: And then it comes out through the gaps?

MR. DINGLER: Right. See where John puts the arrow up there on the picture? That's one gap that it comes out. And here's the gap it comes out.

CHAIRMAN WALLIS: And on this side there's another gap?

MR. DINGLER: And the other two on the other side we put barriers up to force the water.

CHAIRMAN WALLIS: All right. So the water can't go through there?

MR. DINGLER: That's right.

VICE CHAIRMAN BANERJEE: It has to take the long path.

MR. DINGLER: It has to take the long path.

CHAIRMAN WALLIS: It goes around.

MR. DINGLER: All the way around. We took a little penalty of that because that did increase velocities and stuff --

CHAIRMAN WALLIS: So it comes rushing out and it goes through a vortex and comes back again? All right.

MR. DINGLER: Pretty much so, yes. Very turbulence in that area and there are high velocities coming out of those areas.

VICE CHAIRMAN BANERJEE: So when you say a foot per second there, what elevation is that or is that at average velocity?

CHAIRMAN WALLIS: That is one foot a second, as high as that?

MR. DINGLER: Yes.

CHAIRMAN WALLIS: One foot a second.

VICE CHAIRMAN BANERJEE: Which is what you would expect.

MR. DINGLER: What you would expect, yes. If you even do the simple area and depth in that you get high velocity --

VICE CHAIRMAN BANERJEE: This is what I did for the last, Fort Calhoun, right.

CHAIRMAN WALLIS: So it's one foot a second and it's --

MR. DINGLER: I have the open flow man that does those flow areas --

CHAIRMAN WALLIS: -- ten foot passage so that the Reynolds number is humongous.

MR. DINGLER: Absolutely.

CHAIRMAN WALLIS: Right.

MR. DINGLER: There's no credit taken for settling i this area. We have some large intact blankets that we're evaluating won't get out of the bioshield because they're six two by eight by four or something like that, and they're intact blankets. And I'll show you that in the slide of what we have.

VICE CHAIRMAN BANERJEE: I'm glad. Because you do have some recirculation areas, but they're not significant.

CHAIRMAN WALLIS: Not significant.

VICE CHAIRMAN BANERJEE: This looks more like what I would have expected it was to look like.

CHAIRMAN WALLIS: Maybe it's a simpler situation.

VICE CHAIRMAN BANERJEE: Yes.

MR. DINGLER: The flow here is about 17,660 gpm.

VICE CHAIRMAN BANERJEE: Come with those numbers again.

MR. DINGLER: About 17,660 gpm. That's both trains running with all pumps running. And when you start up, we activate both trains, all pumps.

VICE CHAIRMAN BANERJEE: And what code

are you using to do this calculation?

MR. DINGLER: I'm sorry?

VICE CHAIRMAN BANERJEE: What's the code? It's your own code or you're using somebody else's?

MR. DINGLER: Somebody else's. Alion did the evaluation for us.

VICE CHAIRMAN BANERJEE: I see.

CHAIRMAN WALLIS: Now I'm trying to relate to the --

VICE CHAIRMAN BANERJEE: FLOW-3D?

MR. DINGLER: FLOW-3D.

CHAIRMAN WALLIS: The figure you gave us at the beginning showing the plant and where the steam generators were and so on.

MR. DINGLER: Yes.

CHAIRMAN WALLIS: I'm just trying to go back to that.

MR. DINGLER: No problem.

CHAIRMAN WALLIS: Where is that? Where is the -- the other one.

MR. DINGLER: Sheet 8. Sheet 8.

CHAIRMAN WALLIS: The other one. Here.

So I have trouble relating these --

MR. DINGLER: That's an upper deck, Dr.

Wallis.

CHAIRMAN WALLIS: This is an upper deck. The yellow one's an upper deck.

MR. DINGLER: The yellow one's an upper deck.

CHAIRMAN WALLIS: So I shouldn't -- okay. So that's why you can't see the strainers at all?

MR. DINGLER: That's correct.

CHAIRMAN WALLIS: The strainers are underneath there?

MR. DINGLER: That's right.

CHAIRMAN WALLIS: Because I thought they looked pretty small. But these are pretty big.

MR. DINGLER: That's eight by eight sizes.

CHAIRMAN WALLIS: Okay. Even so that looks pretty big. Eight by eight?

MR. DINGLER: But our accumulators it's covering is quite large, too.

CHAIRMAN WALLIS: It still looks big for the diameter of the whole containment. It still looks like a large -- what the diameter of the containment then?

MR. DINGLER: A little over 200

something square feet.

CHAIRMAN WALLIS: It's 200, isn't it? So that just looks too big.

MR. DINGLER: It may be because I tried to fit the picture into the --

CHAIRMAN WALLIS: I think the strainers are too big in this picture.

MR. DINGLER: Yes. It could be because I--

CHAIRMAN WALLIS: Because if it's 200 foot across, then eight foot is not --

VICE CHAIRMAN BANERJEE: He says the opening is just eight foot.

MR. DINGLER: In other words --

VICE CHAIRMAN BANERJEE: It may be artistic license.

MR. DINGLER: Yes, artistic license.

CHAIRMAN WALLIS: I think there's some artistic license.

MR. DINGLER: There's some license in there. People wanted to understand where the sumps were, so they took some artistic -- and I stretched the photo here a little.

CHAIRMAN WALLIS: But the CFD, what does the CFD assume? It assumes there's a sink at the strainer which is uniform or something?

MR. DINGLER: That's correct. And we didn't want to model -- in other words, we'd run the CFD before we had the size and the -- so we didn't model that.

CHAIRMAN WALLIS: Something looks very weird about the way it's flowing around there. But, anyway --

MR. DINGLER: We got a 6 inch curb around that, too.

CHAIRMAN WALLIS: Why should it go around the stainer?

MR. DINGLER: Six inch curb?

CHAIRMAN WALLIS: Why should it flow around like that? Well, okay.

VICE CHAIRMAN BANERJEE: Let ne ask, something knows about the CFD calculation, right, who said FLOW-3D was used? Do you know if the free surface option was used in FLOW-3D for this calculation and for the previous one?

MR. DINGLER: Yes.

CHAIRMAN WALLIS: So it was used?

MR. DINGLER: Yes.

Ready to go to the next slide, Dr. Wallis?

CHAIRMAN WALLIS: I guess you may go to the next slide, yes. Sure.

MR. DINGLER: What I want to do is give you examples, and I got coming up give you the initial conditions and then we got a 30 second slide here of a movie that shows the testing.

In the Nukon at 17 L/D this is at the sump screen itself, we had about 1600 cubic feet for about 17 pick up loads that we have to handle. Seventeen pick up loads.

CHAIRMAN WALLIS: And that's about 100 cubic feet per --

MR. DINGLER: That's right.

And then if we look at a 7 L/D, and again this is an estimate because calculations are still underway whether we use 7/8 on that. It's about 550 cubic feet or about 6 truckloads, pick up truckloads.

Min-K we had estimated at the sump about 1,000 pounds on there. And when we did the testing we showed there were zero pounds being generated at the sump --

CHAIRMAN WALLIS: Now the strainer fits into a hole that's eight by eight by ten or something?

MR. DINGLER: Eight by eight by eight.

CHAIRMAN WALLIS: So that's only 640 cubic feet.

MR. DINGLER: Yes.

CHAIRMAN WALLIS: So presumably this 450 cubic feet piles up above --

MR. DINGLER: That's correct.

CHAIRMAN WALLIS: -- as well as filling the space.

MR. DINGLER: Right. And we'll show you a picture of that that will illustrate that.

One our testing to do the testing at Wyle, I'll give you initial. Next slide.

We had initial testing of the fluid source of 530 degrees F plus or minus 25 degrees.

Initial pressure was 2,000 psig minus 50 plus zero.

We had a reservoir that had sufficient volume to go 30 second blowdown.

And our nozzle was 3.5 actual measure of 3 inch nominal dimension.

CHAIRMAN WALLIS: So that's a pretty big test?

MR. DINGLER: That was a pretty big test.

VICE CHAIRMAN BANERJEE: Where was the test done?

MR. DINGLER: Wyle Labs.

VICE CHAIRMAN BANERJEE: Wyle.

MR. DINGLER: And then what we did was because the pressure and we had to limit the pressure but due to safety issues. And we used a double rupture disk to get the instantaneous break, some discussion about that. So we used that. And we rationed the pressure from the 2250 to 530 to 2,530. And so we rationed those stagnation pressures to come up with the equal type there.

So what I want to do is show up there on the slides the movie. This is the 5 L/D there. Pipe insulation is put on a pipe, latched with three latched there. And --

CHAIRMAN WALLIS: Turn down the lights or something.

VICE CHAIRMAN BANERJEE: We can't see.

CHAIRMAN WALLIS: We're dazzled by these lights.

VICE CHAIRMAN BANERJEE: Again, maybe, walk us through the setup.

MR. DINGLER: Okay. The set up --this right there, the plate right there is the nozzle coming out. The insulation on the right hand side--

CHAIRMAN WALLIS: Where is the nozzle?

MR. DINGLER: Right there. Right there is the nozzle. Here is the pipe insulation. You see right there is three little latches installs around a piece of pipe.

The nozzle is right there. The pipe insulation with the jacketed stainless is right there. The seam is at a 45 degree upward, the thing is coming this way. And the seam with the latches are at 45 degrees so we could get the steam. And then when it hit it there, it would do a worse case of blowing that jacketed off on that --

CHAIRMAN WALLIS: Anyone know how to control these lights up here? Don't we have someone?

MR. DINGLER: That's insulation and the tank and that are back through here.

CHAIRMAN WALLIS: He's pointing to this one.

MR. DINGLER: All right. We can do this one right over here, because it's better.

The nozzle and the pipe insulation. The seam is -- the nozzle come out right there, the seams are 45 degrees upwards. So the force would move --

VICE CHAIRMAN BANERJEE: What's the distance between the nozzle and the --

MR. DINGLER: Simulate a 5 L/D stagnation pressure based on actual installation. So I can't remember exactly that distance, actual in the field. But it's insulation, a 5 L/D.

CHAIRMAN WALLIS: It looks like more than that for this nozzle.

MR. DINGLER: It is more for the nozzle, but remember we took the 2250 psig and 530 large break LOCA and we compared that to a 2000 psig and 530 to get the distances --

CHAIRMAN WALLIS: The nozzle size is 3 inches, and 5 L/D is 15 inches, and that's a lot more--

MR. DINGLER: That is if you do it, but we had wanted to again correlate the stagnation pressure to a large break LOCA actual in the plant of a 32 inch pipe.

VICE CHAIRMAN BANERJEE: Stagnation pressure in the jet or stagnation pressure where? Vessel?

MR. DINGLER: Equivalent volume.

CHAIRMAN WALLIS: Isn't L/D the same, though, it doesn't matter how big the pipe is?

MR. ANDREYCHEK: Dr. Wallis, we were using equipment spherical volume. As a consequence the jet was a little further away. Excuse me. The target was a little further away.

CHAIRMAN WALLIS: Oh, okay. That notorious ANSI standard then?

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

CHAIRMAN WALLIS: All right.

VICE CHAIRMAN BANERJEE: Are there any science behind that or is it just a --

CHAIRMAN WALLIS: It's an NRC regulatory decision.

MR. DINGLER: We'll start over again.

CHAIRMAN WALLIS: Are you going to show us something happening?

MR. DINGLER: Go ahead, John. I got six hours of this.

There's the steam blowing and you don't see too much for the 30 second until it stops, as you can see.

CHAIRMAN WALLIS: Is that a thing going up in the air, straight up? Why is it going straight up in the air there? Is that a jet expansion?

MR. DINGLER: That's just because you

have expansion and --

CHAIRMAN WALLIS: You have expansion, it expands up to --

MR. DINGLER: That's correct.

MR. ANDREYCHEK: Again, if you look at the ANSI model --

CHAIRMAN WALLIS: The supersonics or --

MR. ANDREYCHEK: That's right, it does.

If you look at the ANSI model it does show a fairly broad --

MR. DINGLER: It does have. You see, there's the big force coming right there and there's the pipe, yes.

MR. ANDREYCHEK: That's correct.

CHAIRMAN WALLIS: Plus you got a ground effect on this thing, too.

MR. DINGLER: Which forces it up. So it would force more pressure back up there.

CHAIRMAN WALLIS: It was pretty noisy?

MR. DINGLER: It was. We didn't have the noise on at this time.

So it's a 30 second blowdown. And you can see there it ends. Right there, and I got pictures next coming up, that blanket that stayed on had a direct hit. There's a full intact blanket right there. On the other side there' is a full intact blanket on the other side right there. And I got detailed pictures showing that coming up in the presentation.

MR. ANDREYCHEK: I think it's important to note that the major -- that the blanket that was in the direct jet impact was a 36 inch wide blanket. There were two sacrificial smaller blankets on either side.

The blanket that was in the direct jet path stayed on the pipe. The one blanket that looks like it may have come off slightly was one of sacrificial blankets that was on the side and it was -- it had end effects associated with it and so on and so forth. But the blanket that was in the direct jet impact stayed intact.

MR. DINGLER: And I'll give a picture of that later on.

The next picture, we'll get back to the--

VICE CHAIRMAN BANERJEE: What was the blanket?

MR. DINGLER: Nukon. Fiberglass encased with Nukon insulation.

MR. ANDREYCHEK: It's a standard Nukon

blanket.

MR. DINGLER: What we wanted to show in the Min-K first, and I'll get into it there. I did want to show movies of the Min-K also.

This is the insulation that we have installed with the Min-K above the reactor vessel head. This one right here is damage caused by when we hit a barrier when it blew out of the test rig. So we looked at the barrier, what happens there, and we investigated afterwards. And you can see it crunched the stainless steel jacketed, had minor cracks in the weld only. No separation at all. No Min-K escaped at all.

Next slide.

Now this is the one on the detectors welds and we have the ex-core detectors go right up between the wall there in the vessel. You can see at this point this is a banding -- that bands the two insulation things together. The only thing that it did was it pushed the Min-K or the stainless jacketed in slightly. No weld separation at all in any of this area right here.

Next slide.

CHAIRMAN WALLIS: It just ends there?

MR. DINGLER: Ends right here. There's

no damage at all to the ends at all.

Next slide.

This is the one that has where our wagon wheels, where the nozzle comes out of the nozzles in our loop piping all in there. We looked at the break, any damage here, any damage here. We had no damage at all to the welds and that. All they did was slightly indent the welds and the stainless steel jacketed --

CHAIRMAN WALLIS: How far is this --

MR. DINGLER: This one is probably, we didn't L/D because we actual did a break and showed actual insulation. I'd probably say this about 10 inches away from the blast.

CHAIRMAN WALLIS: How far from the nozzle? Ten inches from the nozzle?

MR. DINGLER: About ten inches.

CHAIRMAN WALLIS: So it's much closer than in the movie?

MR. DINGLER: The movie was the Nukon. This will show actual installation. What we wanted to do was at this location is coming out of the reactor vessel nozzle, you've got about a foot before it goes into the bioshield or support in the wagon wheel. So we wanted to illustrate that distance, not ZOI. That distance to actually show so we could leave that in place. Because there's no type of insulation that we could replace easily to do that. So we wanted to throw all our money together and do one test to actually show that.

MEMBER ABDEL-KHALIK: What's the scale on this picture?

MR. DINGLER: That's probably four foot by three foot, something like that.

MR. ANDREYCHEK: It's prototypic size. That was prototypic size.

MR. DINGLER: We actually went to the manufacturer and have them built actual installation types.

VICE CHAIRMAN BANERJEE: But the distance is scaled according to this infamous formula.

MR. DINGLER: This one was not scaled, the Nukon was. And this one actually we showed the break at the location of where the nozzle and the piping started and we showed the --

VICE CHAIRMAN BANERJEE: So this is prototypic?

MR. DINGLER: This is prototypical to installation at our plant.

VICE CHAIRMAN BANERJEE: But the energy coming out of a big pipe is going to be quite a bit more than comes out of this small pipe, right? I mean --

CHAIRMAN WALLIS: Stagnation pressure is the same.

VICE CHAIRMAN BANERJEE: Stagnation pressure may be --

MR. DINGLER: Same stagnation pressures.

VICE CHAIRMAN BANERJEE: But the total energy would be quite different.

MR. ANDREYCHEK: That may be true, but Dr. Banerjee, what we're looking at is what actually impacts this piece of item. So the jet was impacting the area that we would expect to see the loading applied in the plant. So we believe and our argument is that given the area --

VICE CHAIRMAN BANERJEE: Subtended area?

MR. ANDREYCHEK: The subtended area we've got comparable loading as to what you would expect to see in the plant.

VICE CHAIRMAN BANERJEE: Okay. So because the other thing is sort of -- now imagine that you had a big pipe and the whole thing had directed its blast at this. What would happen?

MR. ANDREYCHEK: Well, again, let me look at the plant, the actual specific integration of the plant.

The wagon wheel design is to structure the piping such that there's a limited ability to displace the piping, the nozzle from the piping. What we looked at was what's the maximum displacement we would expect to see given the reactor vessel could actually twist some amount.

And this particular configuration of testing represents a much larger break than we would expect to see from a displacement of the reactor vessel from the piping itself. So, again, looking at the subtended area, looking at the fact that we're using a 3 inch diameter break as opposed to something that -- and if you're going to separate the piping, you're not dealing with a 3 inch type of a break. You're actually looking at something on the order of about a quarter of an inch or an 8th inch or less. We believe we have a very conservative test given that we've got a three inch pipe hitting on this particular piece of insulation, welded insulation. And we believe we have a very good test that demonstrates that this is a very robust structure that seems --

VICE CHAIRMAN BANERJEE: So this is about restraints which prevent you from displacing the pipe so that a bigger jet impinges on it?

MR. ANDREYCHEK: That is correct.

MR. DINGLER: From the reactor vessel to the wall holding that up we have a massive wagon wheel that allows a movement of less than an eighth of a inch. The gap that we're trying to fill with this new Min-K is less than three eights of an inch, and there are supports on those that holds those in place. So in other words, that pipe at full hot condition has no movement at all.

CHAIRMAN WALLIS: So you cannot have a double ending guillotine break?

MR. DINGLER: At this location we cannot have a double guillotine break. Now, once you go on the other side of this wall, we have to assume a double guillotine, absolutely.

MR. ANDREYCHEK: But this was right at the nozzle where there is movement relative to pipe and the nozzle is limited. And, again, because of that we believe we have a very conservative test given that we were using a three inch jet.

VICE CHAIRMAN BANERJEE: Suppose the pipe cracked or something and it's a circumferential?

MR. ANDREYCHEK: Okay.

MR. DINGLER: And that's what we assumed in that.

VICE CHAIRMAN BANERJEE: Correct.

MR. DINGLER: And that's why we went all the way up to three inch, three and a half inch nozzle or what we have there.

VICE CHAIRMAN BANERJEE: And if it's cracked longitudinally, by chance what was? The sane? You get the same sort of opening or what happens?

MR. DINGLER: Well, usually with this case, and let's forget the Alloy 600 at this point. The LBB allows us not to have leak before break and we can stop that. Currently in our license basis. And if it's Alloy 600, we'll be mitigating these issues so we can get back to LBB.

VICE CHAIRMAN BANERJEE: But there's no cracks --

MR. ANDREYCHEK: No.

MR. DINGLER: Not in this location, no.

VICE CHAIRMAN BANERJEE: Okay. Otherwise I'd be worried.

MR. DINGLER: That's right. I'd be

worried, too. I wouldn't be here today if there was.

MR. ANDREYCHEK: And we chose the --

CHAIRMAN WALLIS: Are you going to talk about the pressurizer?

MR. ANDREYCHEK: We chose the separation--

MR. DINGLER: I'm not going to talk about the pressurizer. That's a different issue.

MR. ANDREYCHEK: Based on the welding itself. I mean, the weld is the weak location in the pipe.

MR. DINGLER: Yes. Just the reactor vessel.

Next slide.

CHAIRMAN WALLIS: Now this says 5 L/D. It looks as if the stand off distance here is sort of five feet or something.

MR. DINGLER: Again, that was the discussion that Tim had that we used stagnation pressure in the movie. This is the actual results from that movie we had. This is the blanket that stayed on. This was the direct path from the nozzle. These were the two external. And you can see these were fully intact blankets, no damage to these blankets.

CHAIRMAN WALLIS: They must have been held against the supports or something so they didn't blow away?

MR. DINGLER: No. They were wrapped. Next slide.

CHAIRMAN WALLIS: They were wrapped before they fell off at the end?

MR. DINGLER: No. They were Velcro that wrapped around right here. This was the one that the direct impingement --

CHAIRMAN WALLIS: Well when they came off in the test they must have got wrapped around something? Otherwise, they would have been over the fence.

MR. DINGLER: No. You can see from the show they just dropped directly off.

CHAIRMAN WALLIS: I understand. But there must have been a pretty big force on them while the jet was blowing?

MR. DINGLER: I would say there would be a good force on them.

CHAIRMAN WALLIS: So something must have held them in place.

MR. DINGLER: Go to the next one. No,

back up one.

This one you see --

CHAIRMAN WALLIS: It's wrapped around the post.

MR. DINGLER: -- wrapped around that post.

CHAIRMAN WALLIS: Right. Right.

MR. DINGLER: Next slide. You can see from here the only damage we had was slightly elongated of the fiberglass blanket around the Nukon and no Nukon was exposed at all.

CHAIRMAN WALLIS: Was it Velcro together?

MR. DINGLER: That is correct. And there's stainless steel jacketed with the latch about here, about here--

CHAIRMAN WALLIS: So it probably depends on where the Velcro is. If you moved this thing around a bit, you might have more propensity to unzip. According to the stagnation point, maybe it doesn't do it. But if you turned it so the Velcro was at 90 degrees to where it is now.

MR. DINGLER: The criteria was we looked at the installation of the stainless and the stainless steel would come off and then this blanket, the Velcro -- there's some that's not to the Velcro was just holding it in place and the stainless steel is there --

CHAIRMAN WALLIS: Well, the stainless has come off. We can see the stainless.

MR. ANDREYCHEK: Correct.

Dr. Wallis, I would look at it perhaps a little differently. And the fact that the Velcro held it in place suggested that this blanket was subjected to the full impact of the jet over the entire duration of the jet impingement.

CHAIRMAN WALLIS: It was. But I was just suggesting that if the Velcro was at a different angle on the pipe, it might let it unzip more readily.

MR. ANDREYCHEK: It may have. In which case you would expect not even to see the elongation.

CHAIRMAN WALLIS: Yes, the pressure is compressing the Velcro. If it had been on the side, it might have tended to pull it off.

MR. DINGLER: And that's true. And you can go to the previous slide. If it came off, it would be like these blankets were.

CHAIRMAN WALLIS: Now in the previous

slide you've got some stainless steel material still there.

MR. ANDREYCHEK: That's part of the sacrificial --

MR. DINGLER: That's the sacrificial.

CHAIRMAN WALLIS: It was initially wrapped around this blanket?

MR. DINGLER: Absolutely. Yes.

CHAIRMAN WALLIS: And then the piece in the middle disappeared?

MR. ANDREYCHEK: That's correct.

MR. DINGLER: Yes. It flew to somewhere.

CHAIRMAN WALLIS: And left this Velcro, which is stronger than the stainless steel in terms of resisting the jet.

MR. ANDREYCHEK: Well, the latches were a little less stronger than the -- and, again, if you take a look at the way that the jacketing was oriented. The jacketing was oriented like this such that it was at a 45 degree angle --

CHAIRMAN WALLIS: I mean, the pressure can get underneath it to lift it off.

MR. ANDREYCHEK: Yes. Exactly. Exactly.

CHAIRMAN WALLIS: So the orientation can

be important in these tests I think.

MR. ANDREYCHEK: That's correct.

MR. DINGLER: And that's why we picked the 45 --

CHAIRMAN WALLIS: So just pressure is not the only criterion?

MR. ANDREYCHEK: That's correct.

MR. DINGLER: Yes. We looked at what the boilers did in their testing and they recommended a 45 for the upper would be the worst case.

Next one.

VICE CHAIRMAN BANERJEE: Did the Velcro unzip?

MR. DINGLER: I can't remember that detail.

CHAIRMAN WALLIS: Anyway, the Staff is going to decide what credit to give you for these tests.

MR. DINGLER: Right.

Next one. Next one.

What we did -- now we'll go into the head loss testing and bypass. This is the original test we did on there. And we used what we felt was realistic open flow channel testing. We used the scale --

CHAIRMAN WALLIS: That was an interesting thing with the question being raised these whole two days is whether or not these tests are realistic.

MR. ANDREYCHEK: We agree.

MR. DINGLER: As you can see we're in the process of redoing some of this test and we go on and we have interaction with the Staff at this time.

We had a scaled module in the next couple of slides we got some pictures of that. Scaled debris based on the hypothecated design bases load. We used actual debris and we used some surrogates. Massachusetts has some issues with zinc, and we had to use something else because the zinc was considered hazardous material in Massachusetts.

Here's the issue that we had and what causes us to do some retesting. And we treated chemicals there at a particulate at the time. We were a little ahead of the --

CHAIRMAN WALLIS: What does that mean, treat it as precipitate?

MR. DINGLER: We didn't use it as a hydroxide material, hydrated material.

CHAIRMAN WALLIS: You used flour or something?

MR. DINGLER: We used chemicals that we thought were sort of equal to surrogates.

CHAIRMAN WALLIS: But the particular chemical debris that Argonne had had an amazing ability to clog up the strainer.

MR. DINGLER: Right, and --

CHAIRMAN WALLIS: You have to duplicate that somehow?

MR. DINGLER: We agree, and that's why we're redoing our tests.

CHAIRMAN WALLIS: You're going to redo them?

MR. DINGLER: That's right.

CHAIRMAN WALLIS: So you used some kind of a different surrogate?

MR. DINGLER: We used a different surrogate that we could --

CHAIRMAN WALLIS: Which was a stone flour or something like that?

CHAIRMAN WALLIS: Well, we actually used debris generated but it wasn't --

MR. KUDLA: The material that was used was actually the chemicals, but they were in a particulate crystal form.

CHAIRMAN WALLIS: Ah. They were not in the same precipitant form?

MR. KUDLA: Right. Right. They were not a liquid form. But they were dissolved and then used.

MR. DINGLER: We were a little ahead of the --

CHAIRMAN WALLIS: So you're not going to give us any data?

VICE CHAIRMAN BANERJEE: They're going to show you some pictures.

MR. DINGLER: We're going to show you some pictures, but no data. Because the data's not worth anything right now for us.

CHAIRMAN WALLIS: The data's not worth anything? Is that for the record? Write that down, data not worth anything.

MR. DINGLER: The data has to be redone, let's put it that way, Dr. Wallis.

Okay. All the tests that we had right now, as you heard, the acceptable based on the debris mix and the chemical we used is a crystal area, some form of retesting now is required because we used a nonconservative assumption concerning the chemical precipitates. So now we're looking at doing a retest on there on that.

Some of our bypass. We looked at to kind of maximize our bypass loading on the sump screen based on tests that we did on there. We got 1.16 percent of the input concentration. A little sample calc. If you use a 1000 cubic feet coming to the sump screen, you get about 11.6 cubic feet pass.

We did an SEM on the amount of the fiber that went through our sump screens. Remember we got 0.045 openings. The largest length of fiber we got through that was 1900 microns or .0748 inches. Very small type of debris.

CHAIRMAN WALLIS: So this is something like one cubic foot per square foot of strainer or something, one of these magic numbers?

VICE CHAIRMAN BANERJEE: Well, in this case everything will pile up on top of the strainer.

CHAIRMAN WALLIS: Right. That's very different.

MR. ANDREYCHEK: It's a little different.

CHAIRMAN WALLIS: But you still seem to have this magic number that bypasses a certain amount.

MR. DINGLER: That next amount. Next slide.

Here's some pictures of the actual, some of the testing.

CHAIRMAN WALLIS: This doesn't mean anything to me.

MR. DINGLER: As you can see here --

CHAIRMAN WALLIS: We can see three shovels and --

MR. DINGLER: Well, that's right. And again --

CHAIRMAN WALLIS: Four shovels I see.

MR. DINGLER: The sump pit or the sump is right there in that area there. You can see the debris is all the way around it. We dumped the debris right on top for this test, right on top of the sump.

CHAIRMAN WALLIS: So the strainer is just in that little tiny region down in there.

MEMBER ABDEL-KHALIK: That's right. Right in that tiny region.

CHAIRMAN WALLIS: You don't see any strainer? It's all --

MR. DINGLER: You don't see any strainer there. It's fiberglass, pretty well encompassed around it.

Next slide.

Now that's the strainer that's inside the pit. You can see we're just starting to turn it on. There's actual the pictures of the strainer on there. It's perforated pipe top and bottom and on the sides on there.

CHAIRMAN WALLIS: Whose design of strainer is this?

MR. DINGLER: PCI.

CHAIRMAN WALLIS: PCI strainer.

MR. DINGLER: Okay. Next slide.

Here is where it shows the debris is coming in from the top. We're just starting there because we waited until the other slide, the first slide area you couldn't see it. But you can see at this point you have debris resting on the sides. Very little debris being carried into the screens because of the low velocities within the screen itself.

CHAIRMAN WALLIS: The screen seems to be chunks of fiberglass and not small fibers.

MR. DINGLER: Those are small fibers there. We mixed it up. We used five fines and mediums and stuff.

CHAIRMAN WALLIS: So there are fines in here?

CHAIRMAN WALLIS: Yes, there are fines in there. The fines are right in this area right in here.

VICE CHAIRMAN BANERJEE: Now the strainer that you've put into the pit in the plant has a pretty small clearance between the wall and its edges, right?

MR. KUDLA: That's correct.

VICE CHAIRMAN BANERJEE: Is this representative of that?

MR. KUDLA: Yes.

MR. ANDREYCHEK: Yes.

VICE CHAIRMAN BANERJEE: So it's a transparent --

MR. KUDLA: Plexiglass flume.

VICE CHAIRMAN BANERJEE: But actually the distance between the edge of the strainer and the wall is about the same?

MR. KUDLA: It's the same, right.

CHAIRMAN WALLIS: Now also there are strainers in this middle of this cube of strainers, aren't there?

MR. KUDLA: That's correct.

CHAIRMAN WALLIS: So that in order for the stuff to get to the middle, it has to go past all the other strainer?

MR. KUDLA: Right.

CHAIRMAN WALLIS: So there are access lanes between the strainers?

MR. KUDLA: There's spacing between the strainers --

CHAIRMAN WALLIS: Right.

MR. KUDLA: -- both in the X and Y plans as well as the water would come down --

CHAIRMAN WALLIS: Right. Well, that's where the water would go through there.

VICE CHAIRMAN BANERJEE: How big is the spacing between the edge of the strainer and the wall?

MR. KUDLA: I believe not exactly but somewhere around six inches approximately.

VICE CHAIRMAN BANERJEE: And between the strainers?

MR. KUDLA: It's approximately four inches.

VICE CHAIRMAN BANERJEE: Just a little bit smaller?

MR. KUDLA: Right.

VICE CHAIRMAN BANERJEE: And between each plate?

MR. KUDLA: Each plate has a one inch gap.

VICE CHAIRMAN BANERJEE: So that's a one inch gap there?

MR. KUDLA: That's a one inch gap. The plates are nominal half inch thick, you know, internally. And with the per plate it's about five-eights of an inch thick.

VICE CHAIRMAN BANERJEE: And it's got holes on the sides and front.

MR. DINGLER: That's correct.

MR. KUDLA: You've got holes on the collection pipe in the middle and you've got the perforated plate that also has the collection holes.

MR. DINGLER: Go back one slide, previous slide. You can see the holes right there. You can see the holes right through there on there.

VICE CHAIRMAN BANERJEE: And you told us, but I've forgotten. It's about how big on each of these sides of the strainer?

MR. KUDLA: You mean the surface -- there approximately I believe was like 22 inches.

VICE CHAIRMAN BANERJEE: And the inner

tube?

MR. KUDLA: The inner tube is approximately, I believe it was -- that one's a small one, it's only about six and a half, six a three-quarters inches.

VICE CHAIRMAN BANERJEE: Is this just scale or is it small?

MR. KUDLA: This is slightly smaller. But it's scaled to the test room for the volume of water we had.

VICE CHAIRMAN BANERJEE: This is sort of still early stage. This must be just before you turned it on?

MR. DINGLER: That's correct. This is before we turned it on. And the next one was early stages. And the first one I showed you was fully encompassed.

VICE CHAIRMAN BANERJEE: So when you have most of the debris there, are these interstitial spaces full of debris?

MR. DINGLER: No.

MR. ANDREYCHEK: No.

MR. DINGLER: We found out that--

VICE CHAIRMAN BANERJEE: They don't--

MR. DINGLER: -- that it was very low,

no compaction and it mostly settled there, so we have to worry about the settling and any compaction around the sides more than we have to do about the others.

CHAIRMAN WALLIS: Presumably this truckload though fills up the whole pit eventually, doesn't it?

MR. ANDREYCHEK: Yes.

MR. DINGLER: And you can see on the first slide it was very loose and fluffy and there was enough forces there to keep it --

VICE CHAIRMAN BANERJEE: But it fills up the pit and outside because --

MR. DINGLER: That's correct.

VICE CHAIRMAN BANERJEE: -- you've got much more than the --

MR. ANDREYCHEK: That's correct. You're assuming 100 percent transportation coming there.

CHAIRMAN WALLIS: How do you calculate the head loss for the real system when you've got this buried pit which is not quite the same as the geometry tested?

MR. DINGLER: Well, this is the same geometry. We tested right there in the pit itself. Go back one.

CHAIRMAN WALLIS: So the pressure drop--

MR. DINGLER: Yes, the sump is right there in the pit. We actually fabricated a pit that actually illustrated us so that the flow --

CHAIRMAN WALLIS: I just know whether the pressure drop is associated with getting into the pit and how much of it is in the pit itself and how much of it is in the strainer.

MR. KUDLA: We calculate what we call clean strainer head loss based off the physical characteristics of the strainer, the piping and the plenum box. That's the first part we do.

The debris laden head loss is based off the testing that we've done. And in the case of Wolf Creek five tests were done under different debris loading parameters characteristics and volumes of material and types of material. Those numbers conservatively we used the worst case head loss. That number is applied with the clean strainer head loss for the higher configuration. And we come up with a total head loss for the system.

VICE CHAIRMAN BANERJEE: I guess what Graham is asking is there's two components of head loss here. One is to flow through that massive debris on top and the other is to flow through the strainer itself.

MR. DINGLER: Right.

MR. KUDLA: And we do calculate. That's what I'm saying, we do a clean strainer head loss of just the strainer as you see it. Everything is addressed based off of previous testing we've done. We have a correlation curve that we've done. We did a number of the boiling water strainers we tested at EPRI and Fairbanks Morris to come up with standards.

And I don't know if you know the background of the PCI strainer, and I don't want to go into a lot of details, but it's a little bit different. It has what they call a suction flow control device where the approach velocity is equal on the outside. So therefore Q always equals, you know, or Q equals AV.

You know, if you're changing the area, then your velocity has to change to keep the Q constant. In our case, the approach velocity is always the same. Therefore, everything stays -- the Q is always the same and we're not changing the surface area or anything like that. So we can use that to extrapolate our head loss numbers that we calculate for module and it continues that way. And we take into account the different length or diameter and we ratio those.

VICE CHAIRMAN BANERJEE: But eventually if you've got many truckloads of stuff, you've got a few truckloads piled up around the outside --

MR. KUDLA: Correct.

VICE CHAIRMAN BANERJEE: -- of the strainer. I mean the strainer is just in the middle there and then you've got this whole bunch of debris outside.

CHAIRMAN WALLIS: Right. And the top is covered, isn't it? It looks here as if the top is -- so all the flow has to go around this six --

MR. DINGLER: That would be correct.

CHAIRMAN WALLIS: -- inch gap around the wall.

MR. DINGLER: Or through if you have no compaction.

VICE CHAIRMAN BANERJEE: Through the middle.

MR. DINGLER: Through the --

CHAIRMAN WALLIS: Can it get through here, too?

MR. DINGLER: Yes. Absolutely.

MR. KUDLA: Yes. There's approximately four inch gaps between the model.

CHAIRMAN WALLIS: So there are gaps in the top of this.

MR. KUDLA: Correct. You have roughly 3300 square feet of surface area. And if you did what they called the circumscribed flow around the outside and assuming that even you don't take credit for the -- I didn't take any of the cross section, it reduces by about 90 percent. You have roughly 300 square feet of surface area.

CHAIRMAN WALLIS: You measured the experiment and then you just take the head loss you get in the experiment and say that's what happens in the real thing at the same conditions? Or do you do some analyses to go from the experiment to the building?

MR. KUDLA: No. The clean strainer we do analyses for the strainer. I mean --

VICE CHAIRMAN BANERJEE: But that's just a geometry problem. You stick it into the pit and you measure the pressure losses right?

MR. KUDLA: No. No. We actually do the calculations for the strainer.

VICE CHAIRMAN BANERJEE: Okay. But that's clean.

CHAIRMAN WALLIS: And then you verify

them with the pit in some way?

MR. KUDLA: We run a test at Alden on the scaled model strainer to see that it's no worse in almost every case -- every case without exception it's always been excessively less than calculated value.

VICE CHAIRMAN BANERJEE: When it's in the pit?

MR. KUDLA: Correct.

VICE CHAIRMAN BANERJEE: Why should it be? I mean, most of the pressure drop is across the holes, isn't it, or is it the turning --

MR. KUDLA: Well, actually --

VICE CHAIRMAN BANERJEE: -- pressure loss or what was the pressure loss?

MR. KUDLA: You actually -- it's basically the flow through the core tube. We have a central collection tube in the design that actually calculates the flow.

The central core tube has a series of holes of unequal size from one end to the other. So what it does is it balances the flow rate of --

VICE CHAIRMAN BANERJEE: Right. Manifold.

MR. KUDLA: Correct. It operates as a

veturi as opposed to an orifice plate.

VICE CHAIRMAN BANERJEE: Right. But the question I was asking is if you look at it from the top, take the plant view, how much open area do you have?

MR. KUDLA: You're talking just --

VICE CHAIRMAN BANERJEE: Just look at it from the top. What is the faction of open area?

MR. KUDLA: Well, it's roughly eight by eight -- sixty-four -- probably about 54/55 square feet.

VICE CHAIRMAN BANERJEE: Right. Okay. So the velocity entering there must be equal to whatever is the flow rate divided by that open area?

MR. KUDLA: That open area.

VICE CHAIRMAN BANERJEE: What is that velocity?

MR. KUDLA: I mean, it'll be higher. But what I'm saying is water is approaching from all surface areas.

VICE CHAIRMAN BANERJEE: No, no, I realize that. But ultimately the water has to go into the pit.

CHAIRMAN WALLIS: To the top.

VICE CHAIRMAN BANERJEE: It goes through

the top. If the top of the filter is impervious, then it can only go through the --

MR. KUDLA: But it isn't. It isn't.

VICE CHAIRMAN BANERJEE: But it's not?

MR. KUDLA: It's not. You have perforated plate across the top of that.

VICE CHAIRMAN BANERJEE: Well, that's not evident from the slide.

MR. KUDLA: Okay. I'm sorry.

VICE CHAIRMAN BANERJEE: Right.

MR. KUDLA: Everything's open. There's perforated plate.

VICE CHAIRMAN BANERJEE: It's all sort of perforated.

MR. DINGLER: It's everything is perforated.

VICE CHAIRMAN BANERJEE: With those alleyways --

MR. KUDLA: Correct. Correct.

VICE CHAIRMAN BANERJEE: And what's the fraction of the perforated area then to the solid area?

MR. KUDLA: You mean the percent open? It's approximately, I believe yours is 045, so I think it's like 28 percent or --

VICE CHAIRMAN BANERJEE: 20 or 30 percent --

MR. KUDLA: -- open area.

CHAIRMAN WALLIS: So presumably you supply all this information to the Staff, you describe the experiment, you give all the numbers, the flow rates and velocity --

MR. DINGLER: We have calculations, right.

CHAIRMAN WALLIS: And measured pressure drop and so on. What was the greatest head loss you measured in this?

MR. DINGLER: It was with the Min-L and that's why we went --

CHAIRMAN WALLIS: You haven't given us any data yet or anything like that.

MR. KUDLA: The Min-K test was approximately .8 feet of head loss.

CHAIRMAN WALLIS: How many?

MR. KUDLA: .8 feet.

CHAIRMAN WALLIS: .8 feet? That's the biggest you ever measured?

MR. DINGLER: Yes.

MR. KUDLA: That's correct.

VICE CHAIRMAN BANERJEE: And the Nukon?

MR. DINGLER: No, it's just the Min-K.

MR. KUDLA: That was the Min-K. Nukon --

VICE CHAIRMAN BANERJEE: But this --

MR. DINGLER: This is Nukon. And that was quite a bit less.

MR. KUDLA: Nukon was .0196.

CHAIRMAN WALLIS: That's Nukon by itself?

MR. KUDLA: No. That's with particulate and everything. That was the design basis best.

CHAIRMAN WALLIS: No chemicals, no real chemicals?

MR. KUDLA: That was with the -- that was chemicals, but that was with the precipitate --

MR. DINGLER: With the crystal.

MR. KUDLA: -- the crystalline material.

MR. DINGLER: That was full design basis loading on there.

CHAIRMAN WALLIS: And what's your limiting head loss for NPSH?

MR. KUDLA: I believe it was about -- I think it's like 8.6 feet.

CHAIRMAN WALLIS: So it would appear that you have a huge margin here.

MR. DINGLER: That's correct.

MR. KUDLA: That's correct. And that's also at the high temperature. In the case of Wolf Creek I believe it was 265 degrees.

VICE CHAIRMAN BANERJEE: Now going back to this thing. There's a pressure loss between the free stream outside the strainer and let's say to the top of the pit, the surface area which comes from debris just being piled up outside. And then there is a pressure loss from the top of the pit into whatever is the outlet to all these manifolds that you have inside.

MR. KUDLA: Right.

VICE CHAIRMAN BANERJEE: Can you measure those separately?

MR. KUDLA: We have never attempted it.

VICE CHAIRMAN BANERJEE: But you could, right?

MR. KUDLA: I don't know. I mean, that stuff --

VICE CHAIRMAN BANERJEE: All you need is a couple of pressure taps.

MR. KUDLA: I mean -- I haven't done it as my area of expertise.

VICE CHAIRMAN BANERJEE: So what you measured is just the free stream pressure and the outlet pressure from the manifolds, is that what you measured?

MR. KUDLA: Pretty much so. I mean, you could measure --

VICE CHAIRMAN BANERJEE: Just take the total pressure loss?

MR. KUDLA: Correct.

VICE CHAIRMAN BANERJEE: But then this starts to depend on how that debris outside distributes, doesn't it?

MR. KUDLA: Well, in a case of the PCI strainer, since you have uniform approach velocity to it, everything theoretically would load equally along the whole strainer or the whole surface area of the strainer.

VICE CHAIRMAN BANERJEE: Well, that assumes that that gets into the pit and then distributes itself amongst all these. But --

MR. KUDLA: Right. And during the boiling water testing, which was a little bit different that we did at EPRI, the strainer after the water was -- you know, once the water started to come down, we also did -- we just threw fibers in there. It coats the surface.

VICE CHAIRMAN BANERJEE: Right. But the

test you're showing here show that the debris is primarily outside and that when you got to the inside parts the debris hasn't got there. If you look at the next two slides.

MR. DINGLER: Yes. Well, this was clean and this one --

VICE CHAIRMAN BANERJEE: Yes. And then the next one --

MR. DINGLER: -- this has just started. Because we couldn't show the screen, as you can see up on the other one, we couldn't see the screen was there.

MR. KUDLA: In the case of Wolf Creek your approach velocity is .0062 feet per second. At those velocities to move anything horizontally it just -- the materials just don't move.

CHAIRMAN WALLIS: I mean it appears that way if the material doesn't get to the strainer then?

MR. KUDLA: In some cases.

MR. DINGLER: It gets to the strainer, but it doesn't compact and cause a head loss.

VICE CHAIRMAN BANERJEE: Look at the velocities in the CFD --

CHAIRMAN WALLIS: It does. To me it

looks that it ought to, yes.

VICE CHAIRMAN BANERJEE: -- it's pretty high. So --

MR. DINGLER: It would get to the sump, but it doesn't compact on the screen.

CHAIRMAN WALLIS: If you look at this picture -- it doesn't have a number.

MR. DINGLER: Compact on the screen. And it compacts and --

CHAIRMAN WALLIS: This one here.

MR. DINGLER: -- it makes a difference on your head loss.

CHAIRMAN WALLIS: You've got an awful lot of debris on top, right?

MEMBER ABDEL-KHALIK: That's correct.

CHAIRMAN WALLIS: That's not the scaled amount, is it? Because if you scaled up from this little sump pit, this would actually fill that whole containment area. It's a huge amount of debris lying on top here. It seems to me far in excess of what will happen in reality.

VICE CHAIRMAN BANERJEE: But most of it will be outside.

MR. DINGLER: Some of it, yes.

CHAIRMAN WALLIS: This is huge. I mean,

the sump, this is about -- at least twice and maybe three times the height of the sump of debris above the sump. I mean, you have 20 feet of debris above the sump in the --

MR. DINGLER: I don't have that.

CHAIRMAN WALLIS: You don't have enough truckloads to put it there?

MR. DINGLER: No.

CHAIRMAN WALLIS: So I don't know why you have so much debris on top in this test?

MR. KUDLA: Because, I mean the spacing between the actual module and the wall can only accommodate so much so that --

VICE CHAIRMAN BANERJEE: Most of it is outside.

MR. DINGLER: Right.

MR. ANDREYCHEK: It's outside.

MR. DINGLER: Most of it stays outside.

CHAIRMAN WALLIS: You just seem to have so much. It seems to be -- debris up here for the scale of the test.

MR. DINGLER: And what we did for this test we actually had water jets to keep it agitated so it was always --

CHAIRMAN WALLIS: So you poured in as

much as you could get in there.

VICE CHAIRMAN BANERJEE: I think we don't know the details of the experiments.

CHAIRMAN WALLIS: We don't know. We don't know. And the Staff is going to get it all under control, so --

VICE CHAIRMAN BANERJEE: You keep saying that.

CHAIRMAN WALLIS: Well, it's true. Because the only way you can really satisfy yourself is to dig into all the details, which are not provided to us here. So --

MR. DINGLER: We'll go onto the --

CHAIRMAN WALLIS: -- I'm just asking the kind of questions that I'm sure the Staff has already asked.

MR. DINGLER: Go to 28.

As it was earlier, prior to the testing on the refinements, even though we had some margins in our head loss, we wanted to look at reducing the amount of debris because the chemical issues. Our aluminum concentration is the fiberglass, is the Nukon. And that's where our aluminum is coming from. So we want to look at that. We're looking at ways to reduce that and that's why we did the testing. Reduce the particulate --

CHAIRMAN WALLIS: The critical thing would appear to be the chemical effects. I mean, you don't have much pressure drop otherwise?

MR. DINGLER: That's correct. Absolutely. And that's why we've reduced the fiber, we reduce the chemical output.

Looking at the plant specific inputs, as we've talked about, in the owners group.

Next one.

The next couple of slides is where we're going. We have interfaced with the Staff once. We have another phone call. And that tentatively scheduled for next week. So some of this is in process.

Stu Gain was supposed to be here. Again, I was saying, he was in the hospital. So this one I give you an overall view of that. The Staff has raised some questions and we're answering some of their questions on that. But we wanted to look at use of full scale modules or disks representing flow streams to the test strainer.

We wanted to limit our scaling.

Near strainer debris transport, we're looking at that.

And the chemical surrogates, we're using generated from the WCAP methodology.

CHAIRMAN WALLIS: You haven't done that yet, using WCAP methodology?

MR. DINGLER: No, we have not. That's why we're doing it.

VICE CHAIRMAN BANERJEE: This is very, very non-prototypical, this geometry. And your previous geometry was prototypical.

MR. DINGLER: What we're looking at this one, this is a schematic. We're looking at even building a facility that has moveable walls, can put structures in and stuff like that to allow to do --

CHAIRMAN WALLIS: Why don't you just use the old facility?

VICE CHAIRMAN BANERJEE: What's wrong with that?

MR. KUDLA: What happened is the old facility cannot take the full size module. In other words, it's physically not big enough. You start to get into effects of localized walls and things like that. And this new facility, actually the little facility that was approximately 250/300 gallons. This is a 3000 gallon facility. So --

VICE CHAIRMAN BANERJEE: That's all

right. But can't you make a pit the same way as that you had there?

MR. KUDLA: Right.

MR. DINGLER: Yes.

MR. KUDLA: This facility will have -- and it's not the exact right size.

VICE CHAIRMAN BANERJEE: This looks nothing like the --

MR. DINGLER: Right. We're actually putting in and manufacturing a pit put in there. So this is, again, a schematic showing the idea on there.

CHAIRMAN WALLIS: You've even turned it on it's side.

MR. DINGLER: Yes.

VICE CHAIRMAN BANERJEE: So in reality it'll go back to the --

MR. DINGLER: It's go back.

VICE CHAIRMAN BANERJEE: -- it's going to be put in a pit?

MR. KUDLA: Right. It has --

VICE CHAIRMAN BANERJEE: Stacks?

MR. KUDLA: -- moveable -- right. It has moveable walls to --

CHAIRMAN WALLIS: When you design this,

do you go to the Staff and say if we did this experiment, do you think it would be any use?

MR. DINGLER: We had two meetings with the Staff -- or one meeting with the Staff. They had questions.

CHAIRMAN WALLIS: The Staff sort of write it off on your experimental design and --

MR. DINGLER: And we have another meeting with them in two weeks.

CHAIRMAN WALLIS: And test it this way, it's going to be okay.

VICE CHAIRMAN BANERJEE: I knew that would --

MR. SCOTT: Mike Scott, NRR.

It is certainly correct that we have met with PCI and several of their customers. And I guess it wasn't a public meeting. It was a proprietary meeting recently. And they presented their new protocol. And as was pointed out correctly, we had a number of comments on it. We think in general that it is approved over what was there before, but there are a number of items yet to be taken care of.

It is our objective to resolve the issues that we have with their current proposed testing before they test so that they don't have to test yet again. And that is our objective for all of the chemical testing, integrated head loss testing for the industry. And as you're all fully aware, this is all in a compressed time period. And so we are attempting to encourage all of the vendors and the test folks to come in and tell us what they're going to do, give us the opportunity to comment on it so that they, so to speak, get it right the first time.

So, yes, we're working with all of them or attempting to work with all of them at this point.

CHAIRMAN WALLIS: I'm getting a bit worried about this compressed time period. Because it appears that some of these licensees have quite a bit of work to do.

MR. SCOTT: Yes, they do. And as I think we mentioned, some of the testing goes out into late fall. And that's if they get it all right the first time and then they find out they got it right in November, in the worst case I think maybe --

CHAIRMAN WALLIS: Then you have a pile of paper to review in December.

MR. SCOTT: Well, actually, they have to produce the pile of paper in December.

CHAIRMAN WALLIS: And you get 60 piles of paper in December?

MR. SCOTT: Right. In the middle of the audit. So, yes, it's going to be a challenge --

CHAIRMAN WALLIS: You're going to need pickup trucks just to bring the piles of paper.

MR. SCOTT: Well, we're trying to work on the level, as I mentioned, the level of detail that we need so that we don't have to get a pickup truck to do that. But there have already been discussions about well what happens if I'm the licensee and I'm doing my testing in November, can I have additional time. And the Staff has said that we're not at this point receptive to a generic "we can't get there from here" statement.

CHAIRMAN WALLIS: Won't you have a graduation ceremony or something, these guys have to meet the deadline?

MR. SCOTT: Yes, they do. Yes, they do. The deadline is 12/31/07 to have all this testing done and the analyses in place.

We may well see requests from some of the licensees late in the queue for additional time because this is going on or else their test doesn't turn out right or whatever.

VICE CHAIRMAN BANERJEE: You've got 69 plants?

MR. SCOTT: There are. So what that really means, I think we're going to get about 42 or 43 packages. Because you can assume, for example, that D.C. Cook Unit 1 and Unit 2 are going to have a fairly similar solution set, so that won't be a double review so much.

But, yes, workload, compressed time; it's going to be very challenging for all parties involved. We're continuing to discuss with the industry how to get there from here.

CHAIRMAN WALLIS: And what's our role going to be when you're reviewing these 43 packages?

MR. SCOTT: Look over our shoulders like usual.

CHAIRMAN WALLIS: Okay. I guess you have to work that out, Sanjoy. How many of these packages do you want to see and how much detail, if any.

VICE CHAIRMAN BANERJEE: All different. I think these four are very interesting. They're four very different scenarios.

MR. SCOTT: Yes. I tried to get you a

sample of four. But I would tell you this: If you get five more PCI plants in here, you're going to hear five more variations.

CHAIRMAN WALLIS: What is the sample in terms of completion? Are these four relatively complete compared with the average or are they typical of the average level of completion of the work?

MR. SCOTT: I don't think I'd hazard a direct answer to that.

CHAIRMAN WALLIS: You didn't give us somebody who hasn't got to first base yet.

MR. SCOTT: Right. And as you can see, they're all at first base and nobody's hit a home run yet. There are some plants, and I think maybe John Butler mentioned this to you, there are some plants that are largely standing pat at this point. They believe they have a solution because they are blessed with very low chemical loading and fiber loading. So those folks we didn't want to bring to you because we thought it wouldn't be challenging.

CHAIRMAN WALLIS: Well, maybe things are better than we see in this sump?

MR. SCOTT: There's a broad spectrum here.

CHAIRMAN WALLIS: We'll treat it as typical. We'll treat it as typical.

MR. SCOTT: That's fair enough.

CHAIRMAN WALLIS: Okay. Thank you.

We're near the end.

VICE CHAIRMAN BANERJEE: Well, just one thing I wanted to say about this facility, though. You said it's 3000 gpm?

MR. KUDLA: No. 3000 gallons in the flume.

CHAIRMAN WALLIS: Three thousand.

VICE CHAIRMAN BANERJEE: Okay. What is the gpm?

MR. KUDLA: Well, it's one module. We've got about -- I think there's 40. It's going to be like somewhere in the neighborhood of about 300 to 350 gpm.

VICE CHAIRMAN BANERJEE: 350 gpm. And your full scale system is 17,000?

MR. KUDLA: That's for --

MR. DINGLER: That's both. Yes.

VICE CHAIRMAN BANERJEE: Both sumps?

MR. DINGLER: Both sumps.

MR. KUDLA: Both sumps, and that's almost 8,000 square feet of strainer, surface strainer.

VICE CHAIRMAN BANERJEE: So let me -- I just want to work backwards.

MR. KUDLA: Okay.

VICE CHAIRMAN BANERJEE: So let's say for one sump then we have of the order of 8,000 gpm. Okay. And how many of these strainer modules if I look down?

MR. KUDLA: I believe there's 72 in the Wolf Creek.

VICE CHAIRMAN BANERJEE: No, I don't mean stacked. I just want the top.

MR. KUDLA: It's -- let's see --

CHAIRMAN WALLIS: It's four by four? It's 16.

VICE CHAIRMAN BANERJEE: It's 16. So first strainer module I have the top flow. So it's about 500 gpm, right?

CHAIRMAN WALLIS: Coming down.

VICE CHAIRMAN BANERJEE: Coming down. So it's almost at 350. So you could take one of those stacks put them in and have your 8 inch clearance and your 4 inch clearance and whatever you have.

MR. KUDLA: Yes.

VICE CHAIRMAN BANERJEE: Take one stack, put in one sixteenth or one thirty second of whatever is your truckloads and you'd have a fairly prototypical test, full height, one module.

MR. KUDLA: Correct.

VICE CHAIRMAN BANERJEE: You see what I'm saying?

MR. KUDLA: That's basically what we're planning on doing.

VICE CHAIRMAN BANERJEE: But that's not what this picture --

CHAIRMAN WALLIS: It looks like one module rather than the four.

VICE CHAIRMAN BANERJEE: Yes. If you'd do that, you'd send us into total shock.

MR. KUDLA: Well, actually, this is an Alden schematic. But in the case of Wolf Creek, originally when we tested they did have two modules stacked on top of each other.

VICE CHAIRMAN BANERJEE: So how many in a vertical stack?

MR. KUDLA: Wolf Creek has actually two different stacks.

CHAIRMAN WALLIS: There are five.

MR. KUDLA: Yes.

VICE CHAIRMAN BANERJEE: All right. Let's take the, whatever, as an average test. But you can probably accommodate a full size single stack with appropriate clearances around it to see what happened with the appropriate amounts of debris.

MR. KUDLA: Right.

VICE CHAIRMAN BANERJEE: Representative amounts. And the appropriate amount of turbulence because you know what the flow is now.

MR. DINGLER: Absolutely.

MR. KUDLA: That's correct.

VICE CHAIRMAN BANERJEE: So you can do a fairly good prototypical test.

MR. DINGLER: That's right.

VICE CHAIRMAN BANERJEE: I don't want to design it for you, but --

MR. DINGLER: But, no, that's what you-- you pretty well are explaining what we're thinking about doing.

CHAIRMAN WALLIS: Well, we've established what you can do. Now what are you going to do?

MR. KUDLA: Basically what you --

CHAIRMAN WALLIS: What he just said?

MR. KUDLA: Yes. That's basically what our discussions with the Staff have gone along.

MR. DINGLE: With the Staff is. It's getting it tweaked a little from the Staff, but that's really the proposal.

MR. KUDLA: Basically like when debris is there --

CHAIRMAN WALLIS: But then you can take your results and use them directly to predict what will happen in the plant?

MR. DINGLER: We're still discussing some tweaks on that.

VICE CHAIRMAN BANERJEE: They're more cautious than we are.

MR. DINGLER: That's right. We have at least one more meeting with them, maybe more.

CHAIRMAN WALLIS: So they haven't approved anything until they've approved the final document?

MR. DINGLER: That's correct.

MR. ANDREYCHEK: That's correct.

CHAIRMAN WALLIS: Okay. Are we nearly there?

MR. DINGLER: Again, the next slide. This shows you some of the stuff we're looking at and we're discussing with the Staff. But some of the stuff we talked about. The debris is fairly mixed, test flume, preloaded, chemical precipitate added as a chemical precipitate.

Our downstream evaluation, we're looking at the WCAP. We did some additional ones. You heard yesterday the traditional WCAP took coatings and that as equal hardness. We went out and did some testing on how hard coatings really were and found out they were not quite as hard as the stone and that. So we are using some of that evaluation.

We're also considering some of the EOP changes to reduce our mission times. We don't need our spray pumps running for long periods of time. We don't need high head or low head or intermediate heads going for the 30 days. So we're looking at doing our safety analysis to reduce some of that flow because that's where most of our wear issues are on there.

Downstream, long term cooling. We're looking at the PWROG work and looking at some use of our bypass testing and that.

VICE CHAIRMAN BANERJEE: How much of your debris is expected to be sub .045 inches?

MR. DINGLER: All of it, because that

was the largest piece that we found.

CHAIRMAN WALLIS: So you don't have particles, except the chemical precipitate. Well, precipitate presumably would go through.

MR. DINGLER: We measured fiber, the precipitate I think the SC says 100 percent. So that's -- we measured fiber length of the Nukon.

MR. KUDLA: That is particulate from the coatings.

CHAIRMAN WALLIS: Yes, there is. Right. And we don't know what that --

VICE CHAIRMAN BANERJEE: This may not be a wear issue, but it could be a issue related to --

CHAIRMAN WALLIS: We don't know what happens when paint gets in a hot reactor.

MR. DINGLER: Right. And that's some of the evaluations, some of the RAIs the Staff has asked on that.

Summary of the activities. You can see analysis and testing effort has been extensive. We're proposing to do some more testing.

We're reanalyzing on an ongoing basis to look at our source term and stuff like that.

We're looking at doing some additional integrated head loss testing with the chemical effects are being scheduled, as you heard.

Some of the procedure, as Joe said from Omaha, we already incorporated. Operator actions to secure containment -- one containment spray pump before recirc alignment, refilling the RWST tank or refueling water tank.

CHAIRMAN WALLIS: Where from?

MR. DINGLER: Pardon?

CHAIRMAN WALLIS: Where from? Where's the water come from?

MR. DINGLER: Condensate storage tanks make up water and stuff like that.

CHAIRMAN WALLIS: So other sources of water?

MR. DINGLER: Other sources of water.

We're also looking at for the future a pH profile. What I say in there is we got sodium hydroxide. Do we need to dump the whole tank at once? Can we reduce that and still maintain our pH. We're looking at that.

Temperature profiles. We can see from the chemical area lower temperatures may come out of solution. Do we throttle our CCW to cool the RHR flowback?

CHAIRMAN WALLIS: Can I ask the Staff

about this pH question? I mean, there is some question about whether you need this much pH control. Is that still being studied and is it likely to influence the course of events for GSI-191?

MR. SCOTT: This is regarding buffers again?

CHAIRMAN WALLIS: Yes. I mean, do you really need all that much alkaline or buffer?

MR. SCOTT: Well, again, the buffer issue is certainly before us. And we believe that additional questions need to be asked and testing done to support whether we could make a change to that.

CHAIRMAN WALLIS: So you're not to the point where it looks likely that you might change something?

MR. SCOTT: Not within the time scale that we're talking about for GSI-191.

CHAIRMAN WALLIS: So they have to live with the existing buffer requirements?

MR. SCOTT: That's correct.

MEMBER KRESS: And those buffer requirements came about because they're in severe accidents, they're sources of acids that can get in there including oxygen from the atmosphere and the various materials. And those were estimated. And there's a lot of uncertainty in there.

CHAIRMAN WALLIS: That's right.

MEMBER KRESS: So the amount of buffer that's needed was to be sure you kept the --

CHAIRMAN WALLIS: You get some buffering from the cesium and the --

MEMBER KRESS: You actually get some basis came in, too. And all those are estimated.

CHAIRMAN WALLIS: Right.

MEMBER KRESS: And there's a lot of uncertainty there.

CHAIRMAN WALLIS: Yes.

MR. SCOTT: And as Paul Klein mentioned yesterday, the absence of a buffer doesn't mean the absence of chemical effects. It means different chemical effects.

CHAIRMAN WALLIS: Right. Yes.

MEMBER ABDEL-KHALIK: How well can you actually make the temperature corrections for the pH calculation, especially near the elevated temperature range, like you said 260 degrees.

MR. DINGLER: Based on I'll just speak for Wolf Creek, we cool down probably in a very couple of days we're cooling down with the --

MEMBER ABDEL-KHALIK: You know, if you know the composition of what's in there, how well can you predict the pH as a function of temperature, knowing that the temperature can change significantly?

MR. DINGLER: As Dr. Kress said, there's some uncertainties in that and we just -- one of the RAI questions is from the Staff is produce a pH and temperature curve for our sump water. And we're in the process of doing that.

MEMBER KRESS: The interesting thing about the buffer to me is that it's in there for control of the iodine. But long term cooling, if you're having long term cooling, you're not going to have iodine in there.

MR. DINGLER: That's right.

MEMBER KRESS: So there may be a question of timing of when you to introduce buffers.

MR. DINGLER: The current says you use assume fuel failure the same time you do a LOCA, so you do all that. But if you have long term cooling, as Dr. Kress says, you don't have fuel failure. So can we make those changes and there's been discussion with the Staff. And if we want to take credit for it, we'd have to have further discussions with the Staff if we do that. But that's currently how we got it designed.

The other point, what I'm looking at, in other words, I can't remember the exact figures but we have a pH. Do we actually need that high pH or can we base on knowing the uncertainties, as Dr. Kress says, reduce that to more towards 8, 7 and that. And that's some of the stuff we're looking at.

MEMBER KRESS: As best I remember, 7 would do the job fine.

MR. DINGLER: That's correct. Seven.

MEMBER KRESS: And even 6 would probably do it.

MR. DINGLER: And Staff has pretty well say 7 is the bottom line.

MEMBER KRESS: Yes.

MR. DINGLER: I think we're at 9.5. So we have some flexibility to reduce some of that.

MEMBER KRESS: Well, that's to cover the uncertainties and all mistakes coming in there.

MR. DINGLER: That's right. Do we all need that. So those are some of the things --

VICE CHAIRMAN BANERJEE: Suppose your

testing showed that with chemical effects you got too high a pressure loss? Do you have something up your sleeve to take care of that

MR. DINGLER: Yes. We'll be removing insulation.

VICE CHAIRMAN BANERJEE: Remove it. But do you have any other options open to you other than that?

MR. DINGLER: And put in larger sump screen. We have -- remember the criteria that went in. We minimized the use of our loss of space. So we have some space that we can go back and enlarge our sump screens if we have to.

VICE CHAIRMAN BANERJEE: You could actually come a bit above the --

MR. DINGLER: We could come up and spread them out a little. That means a manifold, but we can -- we thought some of that.

CHAIRMAN WALLIS: You wouldn't have to break concrete to do that?

MR. DINGLER: No.

VICE CHAIRMAN BANERJEE: You could just go sideways, right?

MR. DINGLER: That's right. We can go sideways.

CHAIRMAN WALLIS: As long as you've got enough head under water, you can just go sideways?

MR. DINGLER: That's right. Yes. And the area in there, there is some open areas in there. Our outage people don't want to give that up. They will.

VICE CHAIRMAN BANERJEE: And you probably have a little room with your buffer, too?

MR. DINGLER: That's correct. I have a lot of room with buffer. And also, in other words, we have a design on our already complete that we did four years ago of going to sodium phosphate. We have that design complete, we just haven't installed it. We had some trouble with our sodium hydroxide tank leaking. We fixed that and we didn't want to make the big change, so we have that design ready in case that happens. And that will reduce our chemical by quite a bit, too.

MEMBER ABDEL-KHALIK: Now currently you don't have a curb around it?

MR. DINGLER: Yes, we have a six inch curb all the way around the pit.

MEMBER ABDEL-KHALIK: Okay. It doesn't show up in the picture.

MR. DINGLER: It doesn't show, but we

have one, yes.

MEMBER ABDEL-KHALIK: Okay.

MR. DINGLER: And that's why some of the discussion of the flows were going around. That curb is forcing the velocities away from the curb in some areas.

CHAIRMAN WALLIS: Are we through then with this presentation? Thank you very much.

MR. DINGLER: Thank you.

CHAIRMAN WALLIS: We have gained some time. I would like -- I guess we can do this. To move up the next presentation. It Entergy here? Is Entergy here from Indian Point.

Would you be ready to present at 1:15 instead of 1:45? Okay. So let's do that if there's no objection. We will move everything up by half an hour. We'll take a break until 1:15.

(Whereupon, at 12:15 p.m. the meeting was adjourned, to reconvene this same day at 1:18 p.m.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

1:18 p.m.

CHAIRMAN WALLIS: Okay. Let's get back on the record and come into session.

And we're looking forward to hearing from Entergy about Indian Point and the sumps that are there and how they're going to be fixed up.

MR. DRAKE: Good afternoon.

I'm Richard Drake. I'm the Indian Point Entergy Center Design Manager. Today we have Valerie Cambigianis, who is the mechanical engineering supervisor and she was in charge of implementing the modifications.

We have Adi Irani with our nuclear engineering and analysis group.

We have Jay Baskin and Aaron Smith from Enercon who did the engineering of the strainers and provided the strainers.

And Rob Choromokus from Alion who is doing the debris degeneration job.

MS. CAMBIGIANIS: Good afternoon.

The first slide here, actually I was just going to go back and show you that Unit 2, we're looking at Unit 2 and Unit 3. Unit 2 is on the right hand side of the picture and Unit 3 is on the left hand side. And the small dome, that's Unit 1. That was actually one of the first commercial nuclear reactors. It's since been shut down.

CHAIRMAN WALLIS: One, is that --

MR. DRAKE: Yes, 1 is the middle.

MS. CAMBIGIANIS: See where it G, to the left under GSI.

CHAIRMAN WALLIS: Okay.

MS. CAMBIGIANIS: And the stake is also part of Unit 1.

VICE CHAIRMAN BANERJEE: Is that plume there?

MR. DRAKE: The middle dome, yes.

MS. CAMBIGIANIS: Okay.

VICE CHAIRMAN BANERJEE: And it's just sitting there doing nothing?

MR. DRAKE: We have a team that's actually taken the fuel out finally, doing some decommissioning work. But it's going to be decommissioned with the other two plants. Not for a long time, though.

MS. CAMBIGIANIS: Both Unit 2 and Unit 3 are similar, but there are differences that we will be pointing out later on.

Next slide.

This is our agenda. We're going to be focusing on this presentation the amount of work that we have done, both physical and analysis work.

We'll touch on some of the licensing aspects, but we're going to focus mostly on the technical aspects of this project.

We're going to start talking about the GSI. We'll go over the GSI-191 project team.

And we'll show you the IP2 and IP3 sump layout. We'll talk about the sump strainer design.

And then GSI-191 modifications. And then I have Adi Irani over here. He will be talking about the overall methodology, design basis and full turnover, the alternate break methodology, chemical effects and lastly the path forward.

Next slide.

The project team, the GSI-191 project team is made up of Entergy personnel as well as vendor support.

For Entergy we have project management, engineering, licensing, nuclear engineering analysis and construction services.

For the vendors we have Enocon, they're our primary contractor. They've done multiple calcs for us in support, such as debris gen and containment water level.

We have Alion, they're supporting us through debris transport calcs and our testing.

Transco, they were our strainer fabricators.

And Westinghouse, they're doing calcs for us for the effects on reactor vessel fuels and our ECCS systems.

Next slide.

We have two sumps. And it's kind of unique in the industry. We're one of really the only plants that are in the industry that have these two sumps. One we call the internal recirc sump or I the IR sump. And it's our primary means of recirculation and everything is contained inside containment.

CHAIRMAN WALLIS: These are inside the biological shield, too, aren't they? They're different from the other plants?

MS. CAMBIGIANIS: Right.

MR. DRAKE: Well, it's actually in a separate cubical.

CHAIRMAN WALLIS: It is, but it's inside that ring, though, it's not in the outer containment? It's not near the outer wall of the containment wall itself?

MR. DRAKE: No.

MS. CAMBIGIANIS: It's on the outer crane wall, but it is still inside containment.

CHAIRMAN WALLIS: Right.

MS. CAMBIGIANIS: Whereas you have the vapor containment that takes suction to your RHR system.

Okay. You have both the IR sump and the VC sump. They both have two pumps. The IR sump has the IR pumps into the --

CHAIRMAN WALLIS: Why do you call it vapor containment? What does that mean?

MS. CAMBIGIANIS: It's just what we call containment. VC, vapor containment.

CHAIRMAN WALLIS: So that's just for the sprays, is that what it means?

MS. CAMBIGIANIS: We call it the containment.

MR. DRAKE: Yes, concrete --

CHAIRMAN WALLIS: It's just a backup. So recirculation is the main sump --

MS. CAMBIGIANIS: Yes. And the VC sump--

CHAIRMAN WALLIS: It's just a backup

then?

MS. CAMBIGIANIS: -- is the backup to it.

CHAIRMAN WALLIS: Okay.

MS. CAMBIGIANIS: And that takes suction to your RHR pumps that recirc.

CHAIRMAN WALLIS: Okay.

MS. CAMBIGIANIS: A couple of things I do want to point out. And I'd like to use the pointer here up on the screen, if you don't mind.

The main thing on this slide is you've got the IR sump is right here and the VC sump.

CHAIRMAN WALLIS: Right.

MS. CAMBIGIANIS: Okay. You can see the difference in size. The IR sump is much larger than the VC sump.

A couple of things. This called the crane wall. And as you can see from your pictures there's several entrances into the inter crane wall right through here. This is going to be important and when we start talking about flow channeling, I just wanted to point that out.

Right here is the reactor. We're looking at that a little above 46 foot down. Forty-six foot is the bottom level of containment.

Here's your reactor cavity. We're going to talk about the in-core tunnel, which is right here. In-core instrumentation tunnel is right here.

And then you had asked questions. This is the pressurizer over here up on 95. But we're looking mainly right now at the --

CHAIRMAN WALLIS: Presumably those square things are the basis of the steam generators and the --

MS. CAMBIGIANIS: The squares are the steam generators. The triangles are the RCPs.

CHAIRMAN WALLIS: There are pumps and then the pressurizer is added or --

MS. CAMBIGIANIS: No, the pressurizer is not shown on here because we're not up on --

CHAIRMAN WALLIS: Ohm, not that hexagon?

MS. CAMBIGIANIS: No, that's not.

MR. DRAKE: It's right up at 1 o'clock.

MS. CAMBIGIANIS: Oh, is it.

CHAIRMAN WALLIS: It's the hexagon at 1 o'clock.

MR. DRAKE: Yes, it's o'clock.

CHAIRMAN WALLIS: Right.

VICE CHAIRMAN BANERJEE: This is at ground level basically?

MR. DRAKE: Yes.

VICE CHAIRMAN BANERJEE: And where does that tunnel go?

MS. CAMBIGIANIS: In in-core tunnel? I will show you later on in a slide, but it's actually where your in-core instrumentation goes down at the bottom of the reactor and comes up through. And we're using that as part of our flow channeling scheme.

Oh, I'd also like to point out to you -- can we go back one slide. Right here, and you can see it in your handouts, this is a wall right here. It's inside the inner crane wall and protects the recirc sump. Okay. So that's a wall that's been there.

CHAIRMAN WALLIS: Protects it from what?

MS. CAMBIGIANIS: From blowdown forces in the original.

VICE CHAIRMAN BANERJEE: How high is that wall?

MS. CAMBIGIANIS: It goes all the way up to the ceiling right there.

CHAIRMAN WALLIS: So the material that gets to the sump has to somehow come around that wall or come into the crane wall?

MS. CAMBIGIANIS: That's correct. But we've enhanced our scheme. So I just wanted to point those things out while I had that slide up.

Next slide.

This is a very simplified view just to highlight what the VC sump or and the IR sump are that we have two different sumps with two different ways of injecting into the reactor vessel.

Our primary means is our IR sump, like we stated. And the VC sump we right now use that as a backup.

MEMBER KRESS: The valve is normally closed?

MS. CAMBIGIANIS: It's normally open.

MEMBER KRESS: Normally open?

VICE CHAIRMAN BANERJEE: Yes, but what is an M valve?

MS. CAMBIGIANIS: MOE. Okay.

CHAIRMAN WALLIS: Motor operated? Yes. Presumably.

MS. CAMBIGIANIS: Right. Next slide.

Okay. We're talking about the sump strainer design. We call our sump strainers top hats. And I'll show you some pictures. I just want to go through this quickly.

The top hat strainer module includes in the design a bypass eliminator. And I'll show you a picture of that in a second.

CHAIRMAN WALLIS: Oh, it has a second strainer inside it or something?

MS. CAMBIGIANIS: Yes. It's two cylinders. It's a perforated plate with three thirty-seconds diameter holes and the fiber bypass expected is to be less than one cubic foot. And the cubic foot is important to note because it is less than the quantity to fiber which would result in a thin bed backed up an eighth inch at the bottom of the fuel.

Okay. So if we just flip to the next page.

CHAIRMAN WALLIS: So you could presumably plug up your bypass eliminator, too, as well as the strainer.

MR. IRANI: No, we're going to go through that.

CHAIRMAN WALLIS: You're going to go through that?

MS. CAMBIGIANIS: Yes.

CHAIRMAN WALLIS: because I would be a little concerned by the bypass eliminator being the limiting part of the circuit.

MS. CAMBIGIANIS: We'll go through this.

CHAIRMAN WALLIS: You're going to go through that.

MR. DRAKE: We'll do that in the test.

MS. CAMBIGIANIS: Okay. The next page is actually what the top hat strainer looks like. And as you can see --I'm going to use the pointer again because it's a lot easier.

CHAIRMAN WALLIS: It doesn't show me very much.

MS. CAMBIGIANIS: No, I know, but --

MR. IRANI: We've got several slide on it.

CHAIRMAN WALLIS: Okay.

MS. CAMBIGIANIS: Okay. So basically what it is, it's two designs. I mean it's two cylinders, one inside of each other.

CHAIRMAN WALLIS: Are they perforated cylinders?

MS. CAMBIGIANIS: Yes. Those are perforated plates.

Now what you're seeing is both surfaces of each cylinder, so you've got four surfaces, are actually the strainer surface.

This plat back here gets bolted into the frame and that serves as part of the water box assembly. This is looking inward. This would be on the water box side, and you can see the water like come in through these two areas right here.

CHAIRMAN WALLIS: So there are four surfaces.

MS. CAMBIGIANIS: Yes.

CHAIRMAN WALLIS: And then the inner ones look as if they could be filled up with debris and the other one not so easily.

MS. CAMBIGIANIS: Well, we're going to get to that.

CHAIRMAN WALLIS: Okay.

MS. CAMBIGIANIS: Let's go to the next page, please.

And this is actual pictures. This is looking down. And this is just to show the bypass eliminator. It's basically a mess type material that's put in between in the cylinders themselves.

CHAIRMAN WALLIS: I don't understand.

MS. CAMBIGIANIS: Okay.

VICE CHAIRMAN BANERJEE: What is that mess? Is it steel or --

MR. BASKIN: It's a knitted wire mesh

material. It's all one weave of stainless steel.

VICE CHAIRMAN BANERJEE: Stainless steel?

MR. BASKIN: Stainless steel wire.

CHAIRMAN WALLIS: But it's just at the bottom of the passageway is what --

MR. BASKIN: No. It's the whole annulus.

CHAIRMAN WALLIS: The passageway is sort of annulus shape and then it goes down, and this is at the bottom of it.

MS. CAMBIGIANIS: It's all the way through.

MR. IRANI: And it's almost like we just show that on the next page.

MR. BASKIN: Yes, the next page showed the entire length.

VICE CHAIRMAN BANERJEE: And what's the porosity of this?

MR. BASKIN: Ninety-eight percent porosity.

CHAIRMAN WALLIS: So material that gets through the, whatever you call that, the cylinder --

MS. CAMBIGIANIS: Yes.

CHAIRMAN WALLIS: -- gets caught on this material down here?

MS. CAMBIGIANIS: Yes.

MR. IRANI: Yes. We're going to discuss that on the next slide.

CHAIRMAN WALLIS: You' going to discuss it on the next slide?

MS. CAMBIGIANIS: Okay. This is some testing that was done. And this can show you that, as the title says, since most of the fiber is captured near the surface of the wire mesh, very little fiber is observed at the ends of the mesh material exiting the strainer top hat.

CHAIRMAN WALLIS: So what we're looking at here is the --

MS. CAMBIGIANIS: That's the bypass eliminator.

CHAIRMAN WALLIS: --bypass eliminator, which actually fits inside, too?

MS. CAMBIGIANIS: Yes. See those two.

MR. SMITH: This was presented to the ACRS back in August of last year. We did a little presentation back then.

CHAIRMAN WALLIS: This is another strainer --

MR. SMITH: A secondary filter.

CHAIRMAN WALLIS: -- course and then there's a fine --

MR. SMITH: Yes, exactly. Yes.

VICE CHAIRMAN BANERJEE: Well, this is an off month. Not many of us were there.

MR. SMITH: Okay.

VICE CHAIRMAN BANERJEE: Anyway, going back to this, is this actually perforated or not?

MS. CAMBIGIANIS: Yes. It is.

VICE CHAIRMAN BANERJEE: It is perforated?

MR. SMITH: Oh, yes.

VICE CHAIRMAN BANERJEE: And then you have the wire mesh?

CHAIRMAN WALLIS: Inside it.

MS. CAMBIGIANIS: Yes.

CHAIRMAN WALLIS: I don't see any Bs. Do you see any Bs in this slide? There's no Bs.

VICE CHAIRMAN BANERJEE: It appears to be funny.

CHAIRMAN WALLIS: That's right.

MS. CAMBIGIANIS: The next slide.

Okay. So we'll talk about the modifications. We took a two pronged approach to our modifications, the first being on the installation of our sump strainers. And what we did there was we maximize our screen surface area in both sumps. And then we also did a flow channeling. And we'll talk about that later. But for the IR sump we originally had 48 square feet and we took that up to about 3200 square feet. For the VC sump, which is the VC sump in Unit 2 is smaller than the VC sump in Unit 3. But for Unit 2 we originally had 14 square feet and we're about to 440 square feet.

CHAIRMAN WALLIS: So you put in the most you could put in there?

MS. CAMBIGIANIS: That's correct. Okay.

VICE CHAIRMAN BANERJEE: When you count these square feet, it's all the surface area?

MS. CAMBIGIANIS: In the count of the --

VICE CHAIRMAN BANERJEE: All the four --

CHAIRMAN WALLIS: It's the outer surface area.

MS. CAMBIGIANIS: Yes. The four surfaces.

CHAIRMAN WALLIS: Outer surface area.

VICE CHAIRMAN BANERJEE: No. Outer --

MR. BASKIN: The four perforated tubes, it's a total surface area of those four perforated tubs.

MS. CAMBIGIANIS: Okay. The next page.

CHAIRMAN WALLIS: These tubes were just designed this way because someone like the idea or is there a lot of history of these being used.

MR. SMITH: They're actually, we originally used these at Davis Besse when their strainer, we put in the --

CHAIRMAN WALLIS: And before Davis Besse?

MR. SMITH: At the time --

CHAIRMAN WALLIS: Are they used widely in the industry or some other industry, or are they just designed for nuclear purposes?

MR. SMITH: We came out with this for nuclear purposes.

CHAIRMAN WALLIS: Nuclear purposes?

MR. SMITH: The cylinder is a nice strong design and simple to make. And so far it's done well.

CHAIRMAN WALLIS: And there's no taper or anything to these cylinders?

MR. SMITH: No. It's just a nice round cylinder.

VICE CHAIRMAN BANERJEE: Well, we've seen top hats before which really look like top hats without an inner cylinder.

MR. SMITH: Right.

VICE CHAIRMAN BANERJEE: Right.

MR. BASKIN: We started with just a single annulus. And as we grew and realized that a lot more plants need more surface area, less interstitial volume, we can up with a double top hat, double annulus concept.

MS. CAMBIGIANIS: All right. Then we'll talk about the flow channeling after we go through the strainer, but --

CHAIRMAN WALLIS: What size are these? Sorry. The top hat. They like a top hat in size?

MR. BASKIN: Yes. The outer perf plate is 12 inches in diameter.

CHAIRMAN WALLIS: Okay. So it's a top hat.

MR. SMITH: Yes, Well, base plate is about 15 inches. And the outer --

CHAIRMAN WALLIS: Tall hat?

MR. SMITH: Yes.

CHAIRMAN WALLIS: Okay.

VICE CHAIRMAN BANERJEE: And the diameter?

MR. SMITH: Diameter of the outer

cylinder is 12 inches. The next one is 10 inches, 7 and 5. And they range in length from 21 inches at Indian Point to 33 inches long.

MS. CAMBIGIANIS: That's all depending on the configuration of the sumps.

Also for the flow channeling modifications, we utilized our in-core instrumentation tunnel. We'll go through that.

We drilled holes in our crane wall for our flow. And we also installed gates and barriers. And I'll go over that.

The next slide shows what our IR sump used to look like. And I'm going to use the pointer again.

Basically what this was was there was a one by four grading -- oh, here are your pumps and this is your pump bay.

There used to be one by four grading over here, and that would take out your gross debris. Your water would then come down here, flow underneath this rear wall, up. This was your screen right here and over into your pump bay.

CHAIRMAN WALLIS: And the strainer was the screen then?

MS. CAMBIGIANIS: Yes. That's why our

screen was so small.

What we did for the modification is we moved this checkered plate up here, this grading over here and this entire wall with this screen. It filled up the whole area with strainers. I'll show you a picture.

And like I said, that screen right there was about 48 square feet.

VICE CHAIRMAN BANERJEE: Sort of a similar idea to what they did in the last presentation, right?

MS. CAMBIGIANIS: Yes.

VICE CHAIRMAN BANERJEE: Except your configuration is --

MS. CAMBIGIANIS: Right.

CHAIRMAN WALLIS: All in the flow with as much strainer as possible.

VICE CHAIRMAN BANERJEE: Yes.

MS. CAMBIGIANIS: We also talked about we also are doing flow channeling, too. So we'll get to that.

MR. SMITH: I guess a clarification. There's basically two types of strainer designs out there. In the PWR world you have your pit designs and you have plants with no pit. Basically the suction pipes pop up on the containment floor. And if you have a pit, most plants have tried to use the utilize the pit space for their strainer. Those without pits pretty much are left with having to stretch strainer media out on the containment floor.

VICE CHAIRMAN BANERJEE: Leaving aside the details of how this is done, to a first approximation you've got some surface area bay on the floor?

CHAIRMAN WALLIS: How big is the hole in the floor? It looks as if it's about nine feet.

MR. BASKIN: Ten by ten, is it.

MS. CAMBIGIANIS: It's about that. Or 12 by 10. Twelve by 10 by about 12 feet deep.

VICE CHAIRMAN BANERJEE: It's a little bigger than the one that we saw past, right? That was eight --

MS. CAMBIGIANIS: No, this one is our big one. The VC sump is smaller, and we'll get to that.

VICE CHAIRMAN BANERJEE: Okay.

MS. CAMBIGIANIS: All right. The next page.

This is a cartoon view basically of what was actually installed.

CHAIRMAN WALLIS: You have actually built this now?

MS. CAMBIGIANIS: Yes. Both units are built.

What you can see right here is, as I said it is a cartoon view, so these basically represent your pumps and your pump bay is directly underneath here. And this is your water box right here. And these are all your top hats that go all the way down.

This ladder is not in the plant, actually, but in this area is were our level instrumentation is located.

VICE CHAIRMAN BANERJEE: So you have clearance around these as well?

MS. CAMBIGIANIS: Yes, we do.

VICE CHAIRMAN BANERJEE: And how much?

MS. CAMBIGIANIS: Well, at the top -- remember the walls, these walls go 12 feet down, so they're not true like with anything. At the top is about 6 inches.

VICE CHAIRMAN BANERJEE: All around?

MS. CAMBIGIANIS: Yes. Well, no, no, no. This right here is butted up against -- this water box is butted up against that wall. Okay.

MR. SMITH: Yes. The water box actually has to conduct the flow into the pump bay area on the other side.

CHAIRMAN WALLIS: So how many--

VICE CHAIRMAN BANERJEE: So that goes all the way down?

MS. CAMBIGIANIS: Yes, it does.

CHAIRMAN WALLIS: What kind of stuff are you going to catch in this strainer?

MS. CAMBIGIANIS: Well, we'll talk about that after we go through the flow channeling. Because I'd like to talk about this first and then we'll talk about flow channeling.

CHAIRMAN WALLIS: Is it mostly fiberglass or what is it?

MS. CAMBIGIANIS: It's mostly fines.

CHAIRMAN WALLIS: Most fines?

MS. CAMBIGIANIS: Yes.

MR. BASKIN: Most fiberglass, a little bit of Cal-Sil.

CHAIRMAN WALLIS: There is some Cal-Sil?

MS. CAMBIGIANIS: Okay. The next slide, please.

Now this is what we have without the top hats installed. Like I said, the top hat, the square plate of the top hat makes part of the water box. And as you can see when they're installed, they form up this structure to make the water box.

This right here, that goes into your pump bay. We call that our picture window. And that's the water box here, the water goes over.

Okay. Next slide, please.

This is our VC Sump, IP2. Now IP3 sump is much bigger. Or not much bigger, but is bigger than the IP2 sump. This is just depicting the water box right here with the top hats. Behind here is the line that comes through and that's the suction to our --

CHAIRMAN WALLIS: The top hats are bolted on, are they?

MS. CAMBIGIANIS: That's correct.

MR. SMITH: Yes, it's a cantilevered design where it's bolted to the --

CHAIRMAN WALLIS: Well, you've bolted them, you can't get at them to fix anything?

MR. SMITH: They bolt them in as you build them out.

CHAIRMAN WALLIS: Yes. You have to take out all the top ones to get to the bottom?

MS. CAMBIGIANIS: That's correct.

MR. SMITH: But they're passive. There's no massive or anything.

CHAIRMAN WALLIS: Well, you hope you don't have to fix anything?

MR. SMITH: Well, then you'd have to unbolt them and just work your way down. There are four bolts on each top hat.

MS. CAMBIGIANIS: Right.

VICE CHAIRMAN BANERJEE: But they are watertight, right?

MS. CAMBIGIANIS: Yes.

MR. SMITH: Or gap tight. I mean, they by definition have --

CHAIRMAN WALLIS: Is there a gasket or something in there?

MR. SMITH: No, that's just flap. Flap plate with overlapping.

VICE CHAIRMAN BANERJEE: It doesn't heat, it doesn't matter.

MR. SMITH: That's right.

CHAIRMAN WALLIS: It fills up with fiberglass.

MS. CAMBIGIANIS: Okay. We'll go to the next slide.

This is actually the VC sump installed.

You can see the top hats. This is during construction so there is some material up here that's not there normally. That's just a light. But this is the water box itself.

VICE CHAIRMAN BANERJEE: It sure doesn't look perforated, does it?

MS. CAMBIGIANIS: Well, the resolution--

VICE CHAIRMAN BANERJEE: Is it just the reflection.

MR. IRANI: They are tiny, tiny holes.

MR. DRAKE: They are very fine holes.

MR. SMITH: Three.

CHAIRMAN WALLIS: Yes, three thirty-second of an inch. They're bigger than the previous design.

MR. SMITH: It's three thirty-seconds.

CHAIRMAN WALLIS: Yes, we could see them. You could see them on the other design.

MR. SMITH: Yes.

CHAIRMAN WALLIS: Maybe it's out of focus or something.

MS. CAMBIGIANIS: It's very hard. You should see this area. It's very hard to get people in there. It's 5 by 8, it's tiny.

CHAIRMAN WALLIS: Yes.

MS. CAMBIGIANIS: Okay. Let's go onto the next page, please.

Okay. So now I want to talk about the flow channeling.

The main portion of the flow channeling is to -- the break will take place inside the crane wall. And the whole point is to keep all the large debris inside the crane wall and have more of the filtered water or relatively clean water come out into the annulus areas. And I'll show you a picture of this.

CHAIRMAN WALLIS: And then it comes back in from the annulus?

MS. CAMBIGIANIS: Yes. We have pictures of this.

CHAIRMAN WALLIS: Right.

MS. CAMBIGIANIS: Okay. Let's go to the next page.

This is kind of difficult to show. But, okay. This is a way of our containment 46. But just to give a little of a bearing. That's our reactor vessel right here. As pointed out before, this is our reactor cavity. This is where the in-cores come up through, and that's what we're calling the in-core tunnel. And this is a little -- you got to look at your slides -- but this is where your crane wall. And we cut holes into our crane wall.

So what's going to happen is you're going to have your break and your water is going go down into your reactor cavity and it's going to come up through your in-core -- what we're calling our in-core instrumentation tunnel and out through the crane walls in --

CHAIRMAN WALLIS: How much debris is it going to deposit down below the reactor then?

MS. CAMBIGIANIS: It's a large area. And if you --

CHAIRMAN WALLIS: Well, isn't it going to fill up with debris down there?

MR. IRANI: No. We had --

MS. CAMBIGIANIS: No.

CHAIRMAN WALLIS: It's going to be scooped out.

MS. CAMBIGIANIS: No, and we will get to that.

MR. SMITH: Next slide.

MS. CAMBIGIANIS: We also as part of this, too, we installed barriers over our in-core tunnel. That's so if water does come down and does go into the reactor cavity this way instead of through this way, the large debris would settle out on your barriers. Likewise, there's a barrier over the VC sump over here.

And I pointed out before that there's a wall around the IR sump. We put barriers up against that, too, so water could not get into the IR sump through the inner crane wall.

If we look at our next slide, this is a cross sectional view of our --

CHAIRMAN WALLIS: Why did you go to all the trouble to route this water down to the reactor and back up again.

MS. CAMBIGIANIS: Because the intent is to slow down the water such that your large debris will fall out and settle.

CHAIRMAN WALLIS: You want the large debris to fall out underneath the reactor?

MS. CAMBIGIANIS: Yes. Okay.

MR. SMITH: It's a large settling pool.

CHAIRMAN WALLIS: Yes.

MR. SMITH: And we came up with that idea to basically let it channel the debris to a settling area.

CHAIRMAN WALLIS: And when the accident is over someone goes in and cleans it all out?

MS. CAMBIGIANIS: Yes.

MR. SMITH: If you have a large break LOCA accident --

CHAIRMAN WALLIS: No. If you have an accident which is not quite so severe, but you still have debris.

MR. SMITH: Well then, yes, you would have to clean it out from down there.

MS. CAMBIGIANIS: We do go into the --

CHAIRMAN WALLIS: I mean that in a large break LOCA you're still able to protect the core. So you might actually be able to run the reactor again.

MR. SMITH: Yes, correct. That is correct.

CHAIRMAN WALLIS: So someone has to go down there and clean this out underneath the reactor?

VICE CHAIRMAN BANERJEE: They have all their instrumentation there.

MS. CAMBIGIANIS: Yes. We do have sump pumps down there. People are down there every outage, so it's not a --

CHAIRMAN WALLIS: So it's not a big struggle to get down there and --

MR. SMITH: No, not at all.

CHAIRMAN WALLIS: -- and take this up from all around the instrumentation lines and everything?

MR. SMITH: You just get your shop vac and go down there and suck it all up, I guess.

MS. CAMBIGIANIS: Okay. What I'd like to show you is -- this didn't come out so well on here but on your handout it's pretty good. We're talking about everything up at 46 foot. Down here it's 29 foot and there's --

CHAIRMAN WALLIS: Well, this is a new feature -- excuse me -- of your design. You didn't do this before? Before just the water was on the top level?

MS. CAMBIGIANIS: Well, during any kind of accident your water would fall down there anyway.

CHAIRMAN WALLIS: It would anyway? Okay.

MS. CAMBIGIANIS: All right. But what we did here is we installed -- there is an access platform down here. Like I said, we do need people to get down there in outages to do different activities.

CHAIRMAN WALLIS: Yes.

MS. CAMBIGIANIS: There is an access platform. We put perf plate down on this platform. And what that will do is your flow will come down, it'll catch some of your debris. And it will slow down your flow so that all down in here your large debris will settle out. And what comes up through the in-core tunnel, those are your in-core instrumentations -- in through your in-core tunnel and this is your crane wall over here. All you're going to get is fines.

Now over this in-core tunnel, because water can come this way, obviously, over your in-core tunnels on both sides we have barriers put on with perf plate over that. And as I said, right here is your crane wall. We cut holes into the crane wall to direct the flow into the outside the crane wall.

MEMBER ABDEL-KHALIK: Those barriers surround this hole in all four directions?

MS. CAMBIGIANIS: Yes.

MEMBER ABDEL-KHALIK: The picture shows only three.

CHAIRMAN WALLIS: It doesn't really show it.

MS. CAMBIGIANIS: Well, you can't show

it. We do have pictures.

MR. BASKIN: The barriers are put there to basically to make that as communicate to the outside the crane wall and separate these barriers from the inside.

CHAIRMAN WALLIS: It has to match up with some concrete and stuff so it's not a simple barrier.

MR. BASKIN: Yes.

MS. CAMBIGIANIS: After we installed this we had strict criteria as to these barriers being up against the wall and not having any type of holes.

MR. DRAKE: The in-core tunnel is on three sides because it matches up to a concrete wall. These would put the holes in the walls.

MS. CAMBIGIANIS: If we can just keep going.

MR. SMITH: Yes. These barriers are perforated plate to allow as the containment floods up to help, you know, levelize flow. And basically the barriers would become blocked with debris as the recirculation would start up.

MEMBER ABDEL-KHALIK: And how big are those holes?

MR. SMITH: What is it?

MS. CAMBIGIANIS: Yes, they're half inch holes.

MR. SMITH: Half inch, yes.

MS. CAMBIGIANIS: Basically what is it is a grading. It's tube steel with grading and then perf plate on top of that.

If you go to the next picture, this is actually looking at -- you can see here, I'll point out. These are your in-core instrumentation tubes right here. And the way we're looking, the reactor is to your back. And you can see the perf plate there.

So the water would be coming up through the tunnel and out the back.

CHAIRMAN WALLIS: And then that can clog up there then?

MS. CAMBIGIANIS: You can get debris clogged up on top, but that doesn't matter. You just don't want the debris to get into your relatively clean --

CHAIRMAN WALLIS: I was just wondering if it could clog up to the point where it would restrict the flow?

MS. CAMBIGIANIS: Well, it would go down

your reactor cavity and our reactor cavity we removed all the draining off of that and that's a clear path.

CHAIRMAN WALLIS: So it would spill over in some way?

MS. CAMBIGIANIS: Yes.

CHAIRMAN WALLIS: It would have some way to get out?

MS. CAMBIGIANIS: It has some way to get out, yes. Well, it gets out behind. The holes are behind this gate.

MEMBER KRESS: How big are those holes?

MS. CAMBIGIANIS: Twenty inches by 20 inches. They're actually square.

MEMBER KRESS: And how many of them are there?

MS. CAMBIGIANIS: On Unit 2 we have three of them, on Unit 3 we have two. The ones are on Unit 3 are bigger.

MEMBER KRESS: And so you don't want those plugged?

MS. CAMBIGIANIS: No. Well the 20 by 20, you wouldn't get any debris into those holes because you've got the barriers over those holes, surrounding those holes.

MEMBER KRESS: Just the fines?

MS. CAMBIGIANIS: Yes.

MR. SMITH: And the water would have been settled down below in the settling area.

MS. CAMBIGIANIS: Okay. We could go to the next.

We did basically the same thing for the Unit 3 modifications. We used the same two pronged approach of flow channeling and also the strainers.

As you can see we installed -- the IR sumps on both units are very, very similar. So we installed 3200 square feet, whereas the original was 48 square feet. And for the VC sump for Unit 3, which is bigger, we installed roughly a 1,000 square feet where it used to be 32 square feet. As you can see, for Unit 2 it was 440. So we have more area in the Unit 3 VC sump. And, again, we maximized all the surface area.

Same idea that we used for the flow channeling, we used in-core instrument tunnel. We cut crane wall holes and we installed barriers and gates. Okay.

We could go to the next slide. This is the Unit 3 VC sump. And as you can see, we've got strainer material on both sides of the water box.

And this is a better picture because you can see this is the RHR line, this section of the RHR line actually meets up to our water box.

And that's all I have for the modifications. I'd like to turn it over to Adi Irani for the remainder of the presentation.

MR. IRANI: Okay. I'm on slide 23.

I guess one of the benefits of going last is that, hopefully, you've exhausted all your questions. But you have some, we have some answers.

We can go. You've heard similar presentations before us, so we'll probably go quickly through.

CHAIRMAN WALLIS: Well, no questions could mean we didn't understand a word. We didn't know how to ask any questions.

MR. IRANI: That works for me, too.

CHAIRMAN WALLIS: It's good to have some questions.

MR. IRANI: The overall methodology basically follows the NEI guidance reporter in the NRC SER, and you heard about this. So, basically, you identify your debris sources, you determine the amount of debris that's going to be generated. And then you determine how much of that debris gets transported to the sumps. And then you evaluate the impact of any debris that bypasses the sump and downstream. And you validate your analytical results predictions with testing.

On the next slide we've identified some of the debris that we have.

CHAIRMAN WALLIS: So you have almost everything?

MR. IRANI: Exactly. Both units, this is typical of both units. And both units are considered to be high fiber plants because we have, like you said, almost everything.

CHAIRMAN WALLIS: Have you taken anything out?

MR. IRANI: Yes, we have. And I'll talk about that.

On the next slide, that's 25.

The debris generation we identified 13 break locations and these range from large to the smallest sizes and at different locations to maximize the brief of debris, whether it's high fiber or low particulate or high particulate or fiber. And also to have a proximity to the sump, so more debris would get to the sump. So 13 break sizes were identified.

VICE CHAIRMAN BANERJEE: So let me ask you with the LBLOCAs, the ones which are quite far from the reactor cavity, you still expect your water to run down into the reactor cavity and out through that--

MR. IRANI: The reactor in-core tunnel, yes. That's the lowest elevation. What originally we had, we had the lip on -- we knocked it all down. So now it's flatted. The water has to go down there, it's the lowest elevation.

VICE CHAIRMAN BANERJEE: So it can't flow out to any other part?

MR. IRANI: No. We put gates at all the access between the inner and outside crane wall.

VICE CHAIRMAN BANERJEE: It cannot get through it?

MR. IRANI: That's correct.

MR. BASKIN: It's not very long.

CHAIRMAN WALLIS: Now what's on the steam generators, what kind of insulation?

MR. IRANI: Nukon.

CHAIRMAN WALLIS: Nukon?

MR. IRANI: Yes.

CHAIRMAN WALLIS: That's probably the biggest source of debris is the insulation?

MR. IRANI: Yes. The Nukon and Temp Mat is, right.

CHAIRMAN WALLIS: If you have a LOCA between the steam generators, it would presumably effect two steam generators simultaneously.

MR. IRANI: You will see that on the next slide.

So just a typical --

CHAIRMAN WALLIS: So you have a few truckloads of this stuff, right?

MR. IRANI: We have about 12.

CHAIRMAN WALLIS: Twelve truckloads.

MR. IRANI: So on the next slide we see the zone of influences for RMI, Nukon and Cal-Sil. And you can just briefly how much influence it does have.

CHAIRMAN WALLIS: Have you modified these are these are the ones that were recommended?

MR. IRANI: These are the ones that are recommended.

CHAIRMAN WALLIS: You haven't changed them the way some other people have?

MR. IRANI: Not yet.

CHAIRMAN WALLIS: Not yet?

VICE CHAIRMAN BANERJEE: In the future?

MR. IRANI: Sorry?

VICE CHAIRMAN BANERJEE: Will you be doing in it future?

MR. IRANI: We'll talk about that.

The next is -- so we got the debris generation quantities and we don't have a slide that gives you those values, but we can give you those values.

CHAIRMAN WALLIS: This is an eye test, this one.

VICE CHAIRMAN BANERJEE: How many truckloads you said?

MR. IRANI: Twelve.

VICE CHAIRMAN BANERJEE: Twelve.

CHAIRMAN WALLIS: Twelve truckloads.

VICE CHAIRMAN BANERJEE: And they're mainly the Nukon or --

MR. IRANI: It's the mix that you saw. It's, you know, Cal-Sil --

VICE CHAIRMAN BANERJEE: How much.

MR. IRANI: You want to read some of that numbers.

VICE CHAIRMAN BANERJEE: How much Cal-Sil and --

MR. BASKIN: This is talking about IP2

debris generated quantities. Total fiber quantity is about 1050 cubic feet. Most of that's Nukon. About 1090 is Nukon. 84 Temp Mat, a little bit of Thermal Map.

CHAIRMAN WALLIS: How much Cal-Sil?

MR. BASKIN: And we've got 46 cubic feet of Cal-Sil generated.

MR. IRANI: This is generated, now it doesn't mean it gets to the sump.

VICE CHAIRMAN BANERJEE: Right. Right.

CHAIRMAN WALLIS: Now I'm trying to figure out this flow pattern. Am I supposed to be able to read that?

MR. IRANI: No. Actually, this is an earlier analyses. If you're looking at slide 27. We used FLOW-3D.

CHAIRMAN WALLIS: Why is there so much flow going on in the outer annulus here between --

MR. IRANI: I'm going to explain that.

CHAIRMAN WALLIS: -- the crane wall and the containment?

MR. IRANI: I'm going to explain that. This was before we did the flow channeling into the in-core.

CHAIRMAN WALLIS: Before you did that?

MR. IRANI: Right. And when we did this run we noticed that, you know, we had high velocities and that a lot of debris was going to get to the sumps. And at that point we decided, oh, we got to channel some of that flow. And that's when we went to the flow channeling.

So basically, you know, we have a computation flow dynamics model that has about 2 million cells. And what you see over reach rector represents like 25 cells.

CHAIRMAN WALLIS: Well, it looks as if when it gets to the strainer, it looks like a bathtub vortex or something on this picture.

MR. IRANI: Right. Right. And like I said --

CHAIRMAN WALLIS: You just put a hole in the floor or something?

MR. IRANI: Yes. Yes.

And the next picture is really what we are concerned with --

CHAIRMAN WALLIS: This is before --

MR. IRANI: Before the channeling.

CHAIRMAN WALLIS: So we just forget this one?

MR. IRANI: Forget that one. Right.

Right.

CHAIRMAN WALLIS: So you can forget it.

MR. IRANI: That's a pretty picture.

So the next one really shows what we're talking about over here, and that is that everything has to come down into the --

CHAIRMAN WALLIS: Underneath the reactor?

MR. IRANI: Correct. Everything has to come down the reactor in-core instrument tunnel, has to go over that platform, make a U turn to go out. Okay. So if the debris can be transported by suspension or tumbling, it has to enter the in-core tunnel. This is from the containment floor. And then the debris is going to drop out. Most of the debris we're going to show is going to drop out in the in-core tunnel only to find --

CHAIRMAN WALLIS: Now this is a study flow calculation, but it's quite possible that the vortices will be shed from that left and unsteady way?

MR. IRANI: This color at the bottom?

CHAIRMAN WALLIS: Yes. Unsteady. This is a CFD calculation which doesn't allow unsteady flow, presumably.

VICE CHAIRMAN BANERJEE: So we're using a -- model there.

CHAIRMAN WALLIS: Yes.

VICE CHAIRMAN BANERJEE: K epsilon?

MR. IRANI: I don't have the details.

VICE CHAIRMAN BANERJEE: Who did this?

MR. IRANI: Alion did.

CHAIRMAN WALLIS: It looks like K epsilon in there.

VICE CHAIRMAN BANERJEE: K epsilon?

CHAIRMAN WALLIS: I think it said that further back here somewhere.

MR. BASKIN: I can't recall that one. I don't push the button.

VICE CHAIRMAN BANERJEE: It is a K epsilon.

MR. BASKIN: That sounds familiar.

VICE CHAIRMAN BANERJEE: Steady rands. Not unsteady rand.

CHAIRMAN WALLIS: Well, there's a very interesting little thing out here that is presumably on its way somewhere. I'm not sure that it's going to stay there.

VICE CHAIRMAN BANERJEE: Well, it seems to be less quiescent than it looks here.

MR. IRANI: Yes.

VICE CHAIRMAN BANERJEE: That's for sure.

MR. BASKIN: It's an approximation.

MR. IRANI: Yes.

VICE CHAIRMAN BANERJEE: The question really is how quiescent is it and how much stuff is going to get out? What are the velocities going up there?

CHAIRMAN WALLIS: Well, it shows you over here.

VICE CHAIRMAN BANERJEE: Twenty-two feet per second?

MR. IRANI: Right. That's with the exit. But when it makes the tone, it's more --

VICE CHAIRMAN BANERJEE: Yes. But --

MR. CHOROMOKUS: When it's coming up, it's moving.

MR. IRANI: Sure. It's moving, yes.

VICE CHAIRMAN BANERJEE: Just how much gets entrained into the flow.

MR. CHOROMOKUS: And there's cabling in down there and stuff that can trap debris by nature.

CHAIRMAN WALLIS: So are you taking credit for material being trapped down there?

MR. IRANI: Yes.

VICE CHAIRMAN BANERJEE: How much.

MR. IRANI: Everything. All the smalls, everything except the fines.

CHAIRMAN WALLIS: So the Nukon gets trapped down there except for the fines.

MR. BASKIN: Except for the fines, yes.

VICE CHAIRMAN BANERJEE: And what is a small?

MR. IRANI: Small is less than 6 inches.

VICE CHAIRMAN BANERJEE: Less than 6 inches.

MR. IRANI: Yes.

VICE CHAIRMAN BANERJEE: And what's the fines?

MR. IRANI: Fines is like the fiber. Individual fiber.

CHAIRMAN WALLIS: Well, how do you verify that this stuff does get trapped down there?

MR. IRANI: Next slide.

CHAIRMAN WALLIS: Only theoretically?

MR. IRANI: Yes.

CHAIRMAN WALLIS: Only theoretically.

MR. IRANI: Yes.

CHAIRMAN WALLIS: And you expect

everyone to believe that then?

MR. IRANI: Well, why don't you look at the next slide and we can talk about it.

MEMBER ABDEL-KHALIK: And on a steady state basis the flow rate through this tunnel is balanced entirely by the flow rate out of the pumps?

MR. IRANI: Yes.

MR. BASKIN: Yes. We're conservatively assuming that all flow goes through the in-core tunnel even though there will be some flow through those barriers because they are perforated.

MEMBER ABDEL-KHALIK: And what is the capacity of the pumps?

MR. BASKIN: For again talking about IP2 for the IR sump the maximum sump flurry is 7,000 gpm. For the VC sump the backup sump, the maximum flow rate is 3500 gpm

MEMBER ABDEL-KHALIK: Now in order for this flow to -- this thing is totally filled, right? So there has to be some elevation difference that drives this flow.

MR. BASKIN: Yes. We've calculated what the elevation difference is between the areas inside the crane wall and after you go out of those three holes that are cut for IP2. And we're talking an inch or two. We calculated it and done hand calculations and CFD modeling to determine what that hydraulic loss is.

MEMBER ABDEL-KHALIK: Even when this thing is packed with trash?

MR. BASKIN: Well, the volumes of fiber we're talking about settling in that area only fills it up about two feet. The total depth of the in-core tunnel is 12 feet. And the total capacity -- the total volume of fiber that could possibly fill that volume is about 2 feet. So we're not filling it up completely.

VICE CHAIRMAN BANERJEE: So that 2 feet is equal to 12 truckloads?

MR. BASKIN: No. That's equivalent of about ten truckloads. Two truckloads go to the sump, two truckloads of that.

CHAIRMAN WALLIS: Now there's stuff in this cavity. It's not just a space, isn't it? You've actually got some screen material in there as you showed. That's not simulated in the CFD in anyway?

MS. CAMBIGIANIS: There is on the --

MR. BASKIN: There's screen material on that platform if you go to slide 28.

CHAIRMAN WALLIS: Is it only on the platform or is it somewhere else?

MS. CAMBIGIANIS: It's just on the platform.

MR. BASKIN: Just on the platform.

MR. IRANI: Just the flow channeling.

CHAIRMAN WALLIS: So down below there's just the in-core instrumentation?

MR. BASKIN: Yes.

CHAIRMAN WALLIS: Which doesn't take up much space?

MR. BASKIN: It doesn't take up much space, but --

CHAIRMAN WALLIS: So this on the platform this thing here? I couldn't figure out quite what this was.

MS. CAMBIGIANIS: That's correct.

CHAIRMAN WALLIS: That's on the platform.

MS. CAMBIGIANIS: We installed it on the platform. I mean, that material is on the platform.

CHAIRMAN WALLIS: It's on the platform.

MR. SMITH: But that is the box that covers the exit out of the in-core tunnel that it's part of flow barrier on the exit out in-core tunnel, that picture.

VICE CHAIRMAN BANERJEE: So it completely covers it? Suppose some big stuff came through? Would it clog that thing up or can it go over it or --

CHAIRMAN WALLIS: It just goes over it.

MR. DRAKE: Yes. But it's got a got on it, too. So you can't go over it.

VICE CHAIRMAN BANERJEE: Can't go over it?

CHAIRMAN WALLIS: So it can clog it up then?

MR. DRAKE: But it's a barrier.

VICE CHAIRMAN BANERJEE: So it's like a trainer. Yes.

MS. CAMBIGIANIS: It is like a barrier. And what would happen if it does get clogged up, the water would go to the reactor cavity then. The reactor side of the reactor cavity and come down.

VICE CHAIRMAN BANERJEE: Right. There are other flow paths?

MR. DRAKE: Yes.

MS. CAMBIGIANIS: Yes.

MR. DRAKE: This could be designed to be totally clogged. So it'd be okay.

VICE CHAIRMAN BANERJEE: Yes.

MR. BASKIN: And analytically we asked how we credited this. We're quantifying settling in the in-core tunnel, we have conservatively blocked those other low passage ways to outside the crane wall.

CHAIRMAN WALLIS: So by forcing the flow to go into a relatively well defined geometry, you have more hope of being able to predict what happens, it seems to me?

MR. IRANI: Yes.

MR. SMITH: Well, it was a concept of a settling pond.

VICE CHAIRMAN BANERJEE: Are you being provocative?

CHAIRMAN WALLIS: What? By trying to get you to respond?

VICE CHAIRMAN BANERJEE: Right.

MR. IRANI: Okay. Slide 29.

VICE CHAIRMAN BANERJEE: Well, we will come back to this. But carry on.

MR. IRANI: Well, slide 29 discusses how you --

VICE CHAIRMAN BANERJEE: So ten truckloads come out.

MR. IRANI: So you're going to skip over to slide 29, right?

MR. DRAKE: Yes.

MR. IRANI: Okay. So we're on slide 30.

So we evaluated components downstream of the sump for impact -- bypasses the sumps. And these include the pumps, valves -- et cetera, you heard about all this. This evaluation also applied to the reactor vessel and fuel. For most -- in the reactor vessel, these are large enough for the fibers to pass through and so there will be no blockage. And on the fuel because we have such a small pipe extraction, we don't have an issue, less than one cubic feet.

CHAIRMAN WALLIS: That's because of your bypass capture or whatever you call it.

MR. IRANI: Bypass eliminator.

CHAIRMAN WALLIS: Do you have chemical effects here?

MR. IRANI: It's coming. It's coming. Actually, it's not coming.

MR. IRANI: So the downstream effects has been done with WCAP Rev. 0 and we probably have to revisit it with Rev. 1.

We've also dome some testing, and I'm

going to show some results of the testing.

One of the simple tests we did was dissolution erosion of Cal-Sil. Like a chunk of Cal-Sil in a beaker stood up. And the Cal-Sil we have is what we call older Cal-Sil so it doesn't disintegrate. We saw no erosion, no dissolution of that Cal-Sil.

For head loss for IP2 we've done a head loss test in a three by three array with scaled debris loads and representative velocities. And you will be the results of that.

CHAIRMAN WALLIS: Three by three array, you mean that means nine of these --

MR. IRANI: Right. Right.

MR. SMITH: Top hats. And they're full scale top hates.

MR. IRANI: And you're going to see results of the testing. Okay.

CHAIRMAN WALLIS: Oh, yes. I guess it's coming up.

MEMBER ABDEL-KHALIK: Now your conclusion regarding, you don't have any problems with one cubic foot getting into the vessel based on uniform distribution --

MR. IRANI: Uniform distribution, yes.

MEMBER ABDEL-KHALIK: -- across the entire support plate?

MR. IRANI: Yes. Yes.

MEMBER ABDEL-KHALIK: Do you expect uniform distribution given the flow paths --

MR. IRANI: The uniform distribution would be the worst case because you could have one eighth I think bed form across -- uniformly across. If you have any open area, you don't have an issue.

MEMBER ABDEL-KHALIK: Well, but let's say you block the hit channel, do you have enough cross flow for several channels around the hot channel, would you have enough cross flow?

MR. IRANI: There's enough cross flow. It's not like a BWR where you have channel flow.

MEMBER ABDEL-KHALIK: I understand.

MR. IRANI: So you do have cross flow. And if one channel would get blocked, you would see more flow going into that channel.

MEMBER ABDEL-KHALIK: Okay.

MR. IRANI: But basically the flow coming down the downcomers and entering the core is very uniform throughout the lower plenum.

MEMBER ABDEL-KHALIK: I'm not sure that's true, but that's okay.

MR. IRANI: So let's look at the results--

MR. SMITH: I will clarify that the fiber lengths of that you see in our bypass eliminator are very short. They're almost in a particulate nature. So they're really -- they're not substantial to actually bridge so they show very little or no bridging characteristics after they come through what does go through our secondary filter there. So it is of more of a particulate nature.

MEMBER ABDEL-KHALIK: Thank you.

MR. IRANI: And we also did a fiber bypass test to sort of go single top hat in a flume. The results showed verified the low bypass. And we also did an SEM examination of the fiber bypass and determined that 98 percent of the material that passed through was less tan a 1,000 microns.

Next slide, which was 32, shows the test apparatus that was done. This was done at facilities at Alion.

CHAIRMAN WALLIS: It doesn't really show how they're fitting into an experimental facility.

MR. IRANI: Right. Right.

CHAIRMAN WALLIS: It shows the -- about all it shows.

MR. IRANI: Right. And there's a plexiglass box built around them to simulate the clearances that they have in the actual sump.

CHAIRMAN WALLIS: Which we see in the next slide, but everything is so murky we can't see anything inside.

MR. IRANI: Right. Once you add the precipitates it gets murky, you can't see anything. So now we got to switch to the results of this testing. Oh, by the way, the man with the bucket on the first slide on 32, the man with the bucket actually is on top of these top hats and he's pouring the bucket onto the top of these top hats. So everything goes onto the top hats.

CHAIRMAN WALLIS: And do you have a standard bucket and a standard man?

MR. IRANI: A standard bucket and a standard man.

VICE CHAIRMAN BANERJEE: Now, unlike the tests that we saw in the previous presentation, this is not sunk into a pit?

MR. IRANI: That's correct.

VICE CHAIRMAN BANERJEE: Why didn't you just do it that way?

MR. BASKIN: We built a pit inside this

tank.

VICE CHAIRMAN BANERJEE: Yes, but the fluent to the side, right?

MR. BASKIN: No, the flow is coming from the top.

MR. IRANI: It has to, it's boxed in.

VICE CHAIRMAN BANERJEE: Oh, it's coming from the top?

MR. BASKIN: It's boxed in, Yes. Were boxed in so flow has to come in from the top.

VICE CHAIRMAN BANERJEE: Somebody explain this experiment to me then. How is this happening. You've got a box there with this thing inside it?

MR. BASKIN: Right.

VICE CHAIRMAN BANERJEE: And the flow is coming in in top?

MR. BASKIN: Yes.

VICE CHAIRMAN BANERJEE: It's down and through the box?

MR. SMITH: Yes. We simulated the water level about the top of the top hats to represent the water coverage in the plant as well.

VICE CHAIRMAN BANERJEE: So you don't have a flume into which this is dropped like the previous?

MR. SMITH: It's a large tank.

MR. BASKIN: It's a large tank.

CHAIRMAN WALLIS: And you have a man with a bucket who pours this stuff in?

MR. BASKIN: The debris. I mean, this is a pit design so all the debris is going to come in from the top, go in from the top and all the water flow is going to come in from the top. So we simulated that by creating a box inside this tank to force all the debris and all the flow to come in from the top.

MEMBER ABDEL-KHALIK: And where does the water come out?

MR. BASKIN: You see the suction lines? Yes. You see the suction line on slide 33?

MEMBER ABDEL-KHALIK: Now with this flow arrangement, is this representative of what actually happens?

MR. BASKIN: Yes. Yes.

MEMBER ABDEL-KHALIK: How is that?

MR. BASKIN:

The VC pump at IP2 and IP3 have horizontal function lines coming from the plenum. And we have the same arrangement here in this test.

We have horizontal suction from this box in a plenum arrangement.

MEMBER ABDEL-KHALIK: Where is the elevation of these filters relative to the pipe on the next viewgraph?

MR. BASKIN: The elevation of the suction line relative to the filters?

MEMBER ABDEL-KHALIK: Right.

MR. BASKIN: There's probably two or three foot elevation.

Now, one thing I should point out --

MEMBER ABDEL-KHALIK: Which is which? Which is higher?

MR. CHOROMOKUS: Go back one, John.

You see that flange on the left side of the array?

MEMBER ABDEL-KHALIK: Right.

MR. CHOROMOKUS: Now go to the next one. That's the bulkhead right there.

MEMBER ABDEL-KHALIK: Right. So it's midway along the elevation.

CHAIRMAN WALLIS: Where do you measure the pressure drop then?

MR. CHOROMOKUS: The pressure drop is measured on the inside and on the inside of the plenum, the water level.

VICE CHAIRMAN BANERJEE: But this is not the way your --

CHAIRMAN WALLIS: I don't see a pressure top on this.

MR. CHOROMOKUS: No, it would be inside the tank in the plenum.

CHAIRMAN WALLIS: It's in the pump?

VICE CHAIRMAN BANERJEE: Right. These bolt these on, don't you?

MR. CHOROMOKUS: In the water box.

MEMBER ABDEL-KHALIK: Now your suction lines are actually below the filters, right?

MR. BASKIN: Sure. I understand your question. What you're getting at is what is the internal -- in the plenum and is that modeled in the testing.

VICE CHAIRMAN BANERJEE: And this is not typical of what you're putting in there in the sense that you're bolting those on some structure and --

MEMBER ABDEL-KHALIK: Yes.

MR. BASKIN: That's typical.

VICE CHAIRMAN BANERJEE: And then it's going through a water box, right?

MR. SMITH: Right.

VICE CHAIRMAN BANERJEE: But is this bolted onto something --

MR. BASKIN: To a water box, yes. Yes, it's a water box.

MR. IRANI: On the other end of the water box.

VICE CHAIRMAN BANERJEE: Maybe we should just see a sketch of this.

MR. SMITH: Go to the next slide, I think, John.

VICE CHAIRMAN BANERJEE: See what it looks like.

CHAIRMAN WALLIS: And then the water box connects to this white pipe we see in -- there's a water box somewhere in there.

VICE CHAIRMAN BANERJEE: So it's a transparent water box, is it?

MR. BASKIN: No, you just can't see it in these photos.

CHAIRMAN WALLIS: I don't see anything.

VICE CHAIRMAN BANERJEE: But there is a typical geometry?

MR. CHOROMOKUS: Yes. I mean all nine top hats are bolting into a plenum just like you have in the plant.

VICE CHAIRMAN BANERJEE: Right. And that's all leading to some suction device which is--

MR. SMITH: That's it. Right there.

VICE CHAIRMAN BANERJEE: Far enough down it doesn't matter.

MR. SMITH: Now we've got it. That's a top view, okay, at the end of the best.

MS. CAMBIGIANIS: Do you want me to explain that?

MR. IRANI: It's at the end of the test after the water is all drained out and you can see.

VICE CHAIRMAN BANERJEE: But which -- where is that?

MR. IRANI: It's not in your handout.

CHAIRMAN WALLIS: It's not in the handout.

MS. CAMBIGIANIS: This is the water box, it simulates the water box.

VICE CHAIRMAN BANERJEE: Okay.

MS. CAMBIGIANIS: And the top hat design we pointed out before, the top hats are actually on flat plates, the square flat plates and they make up the water box when it's bolted into the structure.

VICE CHAIRMAN BANERJEE: And the suction line is behind that?

MR. SMITH: Yes.

VICE CHAIRMAN BANERJEE: Okay.

CHAIRMAN WALLIS: And the man with the bucket just sort of distributes as he feels like along that --

VICE CHAIRMAN BANERJEE: On the top.

MR. IRANI: On the top, yes.

MR. CHOROMOKUS: Yes. He has to get all the debris into the --

CHAIRMAN WALLIS: Yes, but he could pour it all down the middle or he could put it down the slides.

MR. IRANI: We're going to show you a couple of more slides after the test.

MR. BASKIN: We try to control it.

MR. SMITH: We actually have an agitator, a trolling motor over in the back corner over there keeping the whole tank --

VICE CHAIRMAN BANERJEE: So everything is suspended?

MR. IRANI: Yes.

VICE CHAIRMAN BANERJEE: And is the flow for the unit typical of what you would expect, like in the top area.

MR. CHOROMOKUS: The approach velocity

through the screen?

VICE CHAIRMAN BANERJEE: No. I mean, how deep -- how many of these cylinders deep is your typical area. I have forgotten.

CHAIRMAN WALLIS: Quite a few.

VICE CHAIRMAN BANERJEE: Yes. You've only got three deep here, right? How deep is it in fact

MR. BASKIN: For the VC it's I think 40, five deep?

MS. CAMBIGIANIS: Yes.

VICE CHAIRMAN BANERJEE: And IR?

MR. BASKIN: IR is eight. Eight maybe.

MS. CAMBIGIANIS: I was thinking it was ten.

MR. BASKIN: Eight to ten.

CHAIRMAN WALLIS: I saw a picture of it somewhere.

VICE CHAIRMAN BANERJEE: And so the approach velocity from the top here will be maybe half what it would be typically if you were eight deep, give or take, right?

CHAIRMAN WALLIS: Something like that.

VICE CHAIRMAN BANERJEE: So why don't you just make it eight feet?

MR. BASKIN: The limitations of the tanking we have.

VICE CHAIRMAN BANERJEE: Do some in three, do some in eight.

MR. BASKIN: Well, limitations of the tank that we have.

VICE CHAIRMAN BANERJEE: Right. But you're trying to be prototypical here, aren't you?

MR. BASKIN: But we are dumping everything in this box, all the debris, and the --

VICE CHAIRMAN BANERJEE: But you are dumping proportionately, right, aren't you?

MR. BASKIN: Proportionate to the surface area that we have modeled compared to the surface area in the plant.

VICE CHAIRMAN BANERJEE: Sure. But I'm just saying that approach velocity going down from the top, it's only three deep here so in proportion to the approach velocity, it's half what the approach velocity at the top would be or less than half for an eight deep or a six deep area. So I think more prototypical --

CHAIRMAN WALLIS: It looks nine deep in this one.

MS. CAMBIGIANIS: It's nine deep--

CHAIRMAN WALLIS: It's nine deep, yes.

MS. CAMBIGIANIS: -- for the VC sump. the Unit 3 VC sump it's six deep.

VICE CHAIRMAN BANERJEE: A bigger tank?

CHAIRMAN WALLIS: Yes. Because it's nine.

MR. BASKIN: I'm not sure how that would effect the results, though.

VICE CHAIRMAN BANERJEE: Well, velocity -- pressure drop was a square of the velocity, right?

MR. SMITH: The velocity through the media.

VICE CHAIRMAN BANERJEE: Well, I don't-- I'm just saying the velocity.

MR. SMITH: Yes. We're not totally packing the interstitial lining here of the strainer and the strainer system.

VICE CHAIRMAN BANERJEE: But if you were?

MR. BASKIN: If you were, that would be a concern.

VICE CHAIRMAN BANERJEE: Right. So your pressure drop would be, if it was 9 deep, I mean taking the case that you're packing, it would be nine times higher.

MR. BASKIN: Three times higher, yes. Three versus nine.

VICE CHAIRMAN BANERJEE: The velocity would be three times pressure drop?

MR. BASKIN: Pressure --

CHAIRMAN WALLIS: You're talking about the pressure drops in the space between the top hats?

VICE CHAIRMAN BANERJEE: Well, I'm just saying if -- I mean, taking a worst case scenario. Obviously, this is not a worst case scenario.

MR. BASKIN: Right. Understand.

CHAIRMAN WALLIS: Maybe that pressure drop is small compared with the pressure drop through the screen.

VICE CHAIRMAN BANERJEE: Well, it is then --

CHAIRMAN WALLIS: It should be.

VICE CHAIRMAN BANERJEE: Perhaps. I don't know the answer. I'm just saying that this isn't prototypical. And especially when it comes to this chemical effect tests.

MR. BASKIN: Well, as Aaron pointed out, we're not packing it tight. The total volume around the strainers that could be packed with debris is around 400 cubic feet. We have less than 300 cubic feet of fiber actually reaching the strainers.

VICE CHAIRMAN BANERJEE: Right. But I mean that's depending on all this coming out here and there --

MR. SMITH: And it's dependent upon the debris generation and --

VICE CHAIRMAN BANERJEE: So you have close enough --

MR. SMITH: Yes, exactly.

VICE CHAIRMAN BANERJEE: -- so, you know, I wouldn't sharpen that pencil.

MEMBER ABDEL-KHALIK: I guess all of these questions pertain to the same issue that was raised earlier as to the prototypicality of the experiments vis-à-vis the actual system. And if you can just show why the results of these experiments can actually be used to quantify whatever pressure drop you would expect in the actual system, that would be important.

CHAIRMAN WALLIS: Now in this picture, do these top hats extend below this plate which we see there or they stop at that plate?

MR. SMITH: Stop at that plate.

CHAIRMAN WALLIS: Stop at that plate.

MR. SMITH: Yes.

CHAIRMAN WALLIS: And it looks as if that yellow stuff is actually bridging the gap at that end.

MR. SMITH: In some of them, yes.

CHAIRMAN WALLIS: Does it do that all the way down?

MR. SMITH: In pockets and parts and pieces.

MR. IRANI: We've got other slide.

MR. IRANI: Could you back up a couple?

CHAIRMAN WALLIS: Is it there because he boarded at that place or --

MR. IRANI: This shows some of the fiber, fiber quantities --

CHAIRMAN WALLIS: I presume you could do a second test, the pattern would be somewhat different then?

MR. IRANI: Yes.

VICE CHAIRMAN BANERJEE: But the bottom line here is that you're close enough to packing all the interstitial spaces, I mean give or take a little bit, that one bounding situation could be that you simply pack everything. And in that case the height that you test becomes important is all I'm saying.

CHAIRMAN WALLIS: Because in order to get to the bottom, it has to percolate through all the debris.

MR. BASKIN: Right. We understand. Yes.

CHAIRMAN WALLIS: Well all that is going to be sorted out, presumably.

MR. BASKIN: Yes.

CHAIRMAN WALLIS: If it hasn't been already.

VICE CHAIRMAN BANERJEE: It may be perfectly, you know you'd get a perfectly good pressure loss then. But you've got lots --

CHAIRMAN WALLIS: Maybe that's the thing to show that it's conservative, is just pack it up and show that it's still conservative.

Okay. So then you have some data, right?

MR. IRANI: Well, yes, slide 34 shows--

CHAIRMAN WALLIS: Velocity is the top line and the pressure drop is the red line, is it?

MR. IRANI: Right. Right. And that shows the sort of data that is collected and documented for these tests. And then these results are used in a strainer certification calculation. The velocity over here is typical to .00 --

CHAIRMAN WALLIS: So all these jumps, you added a bit more debris?

MR. IRANI: Yes. The debris was patched in. The first patch was to provide the insulation, to provide a one eighth inch type bed. That amount was batched in. And then another batch to bring it up to a quarter inch and three quarters of an inch and one inch. I believe either for this experiment or for one of the other experiments we actually batched in 130 percent of the total debris load.

VICE CHAIRMAN BANERJEE: Your estimated debris load after dropout.

MR. IRANI: After dropout. Fines.

Okay.

VICE CHAIRMAN BANERJEE: Did you drop any fiber out --

MR. IRANI: No. A 100 percent of the fibers get to this.

VICE CHAIRMAN BANERJEE: A 100 percent of the fiber?

VICE CHAIRMAN BANERJEE: A 100 percent.

Okay. Next slide is we're going to talk about something different here. Slide 35 --

VICE CHAIRMAN BANERJEE: Just before, it's only about a half of foot of water, right?

MR. IRANI: Right. Right. Right.

CHAIRMAN WALLIS: A half?

VICE CHAIRMAN BANERJEE: And how much margin do you have?

MR. IRANI: We have after the tests for the IR sump, we have about a foot margin for debris only.

VICE CHAIRMAN BANERJEE: Taking this half of foot away --

MR. IRANI: We have available margin is one foot. About one foot.

VICE CHAIRMAN BANERJEE: What temperature?

MR. BASKIN: Well, these tests are run about room temperature, 70 degrees. The NPSH margins that Adi was talking about, occur at temperatures about 212, as in other presentations that was discussed that you pick up a lot more margin long term.

CHAIRMAN WALLIS: This is with no chemical effects?

MR. BASKIN: That's correct.

CHAIRMAN WALLIS: If you put in some

chemicals, you might find a dramatic change in the delta p.

VICE CHAIRMAN BANERJEE: What is your buffer?

MR. IRANI: I'm getting to that.

CHAIRMAN WALLIS: What did he say?

VICE CHAIRMAN BANERJEE: He's coming to it.

CHAIRMAN WALLIS: Oh, he's coming to something.

MR. IRANI: Hopefully I'll get there eventually.

Two new things we're going to talk about is, one is adapting the alternate break methodology and the second is pool turnover.

So the SER allows what's known as an alternate break methodology. And this says that you don't have to -- and this is getting a little bit into licensing discussion now. You don't have to take a single failure for breaks larger than 14 inches, but it requires the design basis rules for breaks smaller than 14 inches, the alternative break.

And because we have the two sumps, this approach allows the VC sump design to be limited to alternate break LOCA debris loads with credit for pool turnover.

So what's the pool turnover strategy? That's on the next slide, 36. At the start of the recirculation the IR sump will be in operation. The VC sump is a standby. It's a backup to the IR sump.

Now we have to postulate a failure at a single active failure or a passive failure. For Indian Point a passive failure is flow blockage.

So if you postulate a passive failure of the IR sump at 24 hours after the start of recirculation, with pool turnover, and I'm going to show that on the next slide, greater than 05 percent of the debris has been collected in the IR sump. This basically means that the VC strainer is essentially clean and this would provide necessary recirculation cooling.

CHAIRMAN WALLIS: So you can sacrifice one sump to save the other one?

MR. IRANI: If we have to. If we have to.

So if you look at the pool turnover plot in the slide, which is 37, you see that this slide shows actually 99 percent of the debris is in the IR sump at 24 hours. In fact, a huge chunk that debris is in the IR sump mich earlier, more like ten hours.

So continuing with the licensing discussion and alternate break methodology, go to slide 38. We have the large break LOCA. We don't have to assume a single failure with adapting alternative break methodology. This is where you're trying to get the right. That IR sump has to handle the debris plus chemical loads for at least 24 hours. And then if there is a blockage in the IR sump, then the VC sump is available to handle the residual debris and the residual chemicals which are really small following 24 hours of IR sump recirculation.

VICE CHAIRMAN BANERJEE: So you turn it on at that point?

MR. IRANI: Correct.

VICE CHAIRMAN BANERJEE: Your other sump?

MR. IRANI: Correct. Correct.

VICE CHAIRMAN BANERJEE: Otherwise it's not operating?

MR. IRANI: It's not operating. Correct.

MEMBER ABDEL-KHALIK: So when during the accident do your emergency operating procedures require both sets of pumps to be operating?

MR. IRANI: Well, we don't have both sumps operating. If you're not getting enough flow through your IR sump, if the operator has an indication that there's not enough flow, and he would try and get enough flow to take care of boil off in the core by turning on the VC sump.

MR. SMITH: Both sumps never operate at the same time. That's correct.

MEMBER ABDEL-KHALIK: Okay. Thank you.

CHAIRMAN WALLIS: And how does the operator know that he should this?

MR. IRANI: The flow indications.

CHAIRMAN WALLIS: There's flow indication and he makes an energy balance or --

MR. IRANI: No. The EOPs actually have a guideline in there tell them if you don't have so much flow, then you need so much of a minimum flow.

And similarly for alternative break LOCA on this slide you can now postulate a single failure. And because the IR sump is single failure proof, single active failure proof, you come back to the same statement that the VC sump will handle the debris and chemical loads if you postulate a passive failure of the IR sump for 24 hours.

MEMBER ABDEL-KHALIK: Well, you can't

pick and choose your single failure, though? You have to pick the worst single failure.

MR. IRANI: Right. And the worst single failure -- because the IR sump is single active failure proof, the worst single failure would be the passive failure at the time of a recirculation. Twenty-four hours after recirculation.

VICE CHAIRMAN BANERJEE: But if your VC sump was failing for some reason and your IR sump, you'd still have to prove that your IR sump can handle the load, right?

MR. IRANI: Yes. The IR sump must be able to handle -- if you look at the second bullet. The IR sump needs to handle an alternate break LOCA load including -- debris load including chemicals.

VICE CHAIRMAN BANERJEE: But you're arguing that this can be less than 14 inches?

MR. IRANI: Fourteen or less, yes.

VICE CHAIRMAN BANERJEE: Is this now a rule or what is it, Mike. Is it SER or --

MR. SCOTT: That's correct. The Staff SE back from 2004 allows an alternate methodology that they're talking about here.

VICE CHAIRMAN BANERJEE: Okay.

MEMBER ABDEL-KHALIK: But this is only

unique to this plant inasmuch as they have two sumps?

MR. SMITH: That's correct.

MR. SCOTT: Are you asking is the alternate methodology unique to this plant? No.

MR. SMITH: This approach.

MR. SCOTT: The approach is available to be used. We don't know of very many licensees who have elected to avail themselves of it. But it's not just this plant that can do this. And it's not just because they have two sumps. There are different ways you could apply this.

MEMBER ABDEL-KHALIK: Okay.

MR. IRANI: Okay. Chemical effects. We mentioned earlier that the three units are similar but not identical. And here's one of the --

VICE CHAIRMAN BANERJEE: Excuse me. With the 14 inch break you'd get less debris --

MR. SMITH: Correct.

MR. IRANI: And less chemicals, correct.

MR. BASKIN: And the IR sump could handle that.

VICE CHAIRMAN BANERJEE: Well, how much debris would you get?

MR. IRANI: Do you have the numbers for

the 14?

MR. BASKIN: We don't have them handy, but it's -- I don't want to quote a number. But it's quite a bit less.

MR. SMITH: Truckloads less.

MR. IRANI: Truckloads.

VICE CHAIRMAN BANERJEE: Some truckloads. Half a truck.

MR. SMITH: And so the percentage of fines would come down and that's the percentage--

VICE CHAIRMAN BANERJEE: Yes, proportionately.

MR. SMITH: Proportionately, exactly.

VICE CHAIRMAN BANERJEE: Okay.

MR. IRANI: All right. So at one time both units did have the same buffer, sodium hydroxide. But in the late '90s Indian Point decided to change to TSP. And the last outage we are planning to change Indian Point 3 to TSP also, but all these chemical issues came up with TSP, and so that got put on hold.

So we have one unit with trisodium phosphate and the other with sodium hydroxide. For Unit 2 we have the issue of calcium phosphate formation. Right now we use the WCAP for predicting the quantities of calcium phosphate. And for Unit 3 and Unit 2 we have sodium aluminum silicate formation with whatever buffer you have.

So the quantities, the approximate quantities of calcium phosphate for Unit 2 is about 160 kilograms. We plan on changing our buffer for Unit 2, basically eliminating all the calcium phosphate formation. So that leaves the sodium aluminum silicate, which still needs to be handled for both units.

CHAIRMAN WALLIS: So have you tested head loss with the chemical effects or not?

MR. IRANI: No, not yet. No.

CHAIRMAN WALLIS: You don't want to try that?

MR. IRANI: No. Not yet.

CHAIRMAN WALLIS: Until you reduce it?

MR. IRANI: Exactly. Exactly.

So what other options to try and get as low as possible amounts of chemical precipitates? We're going to do some work on reducing debris amounts. We are looking at applying some of these recent test results to us as far as ZOI goes and some EPRI data on coatings, chips.

CHAIRMAN WALLIS: So what you will do

when you produce your chemical effects, is you'll do another test like the one you showed us here but then you'll put in your chemicals?

MR. IRANI: Actually, at the end of this presentation we're going to right to -- Rob's going to present a potential test we are looking at right now.

CHAIRMAN WALLIS: Okay.

MR. IRANI: Which will address chemical effects.

I'm on slide 40. So the refinement to the PWR owners group WCAP has just been released. We're looking at that to see if there's any benefit there, a preliminary look at it. Because of our PPM quantities it doesn't look like we're going to gain much out of that.

We did a walkdown to try and reduce the aluminum quantity to spray, and that helped a little bit. We have to still -- basically our sprays are like 3½ and 4 hours. There's very little submerged aluminum for both units. There is aluminum corrosion as a result of the sprays and there's aluminum corrosion -- aluminum released through the insulation.

CHAIRMAN WALLIS: Reducing the use of

spray in anyway?

MR. IRANI: It's only on for 3½ to 4 hours, okay.

So for the testing programs another option we are looking at, and this would be a chemical test that utilizes specific chemistry profile, a temperature profile, the pH profile and then it would provide insight into the complimentary and competitive processes that exist in an integrated environment. And that's what Rob is going to be talking about.

And as I mentioned, for IP2 we're going to replace the TSP with sodium tetraborate. For IP3 we are also considering replacement of sodium hydroxide with sodium tetraborate. But the quantities of sodium aluminum silicate that are produced by IP3 are a little higher than IP2 because of the higher pH with sodium hydroxide.

On the next slide 41, we also have had some plan to put some programmatic changes in place for insulation control. All insulation changes in containment will be evaluated for impact on sump blockage. Coatings, qualified coatings inspections will be done and compared and reconciled with GSI-191 walkdown reports.

And containment cleanliness, we'll be performing periodic maintenance activities that will verify the dirt and dust levels.

And on containment closeout, we'll include inspection of the sump strainers and flow barriers.

Aluminum control, which is basically in the past has been based on hydrogen generation, will now also include consideration for chemical precipitates.

The path forward, we talked about revising the debris generation. And we are looking at starting that soon. Some reducing the coatings as a result of some EPRI testing where the coatings are outside the zone of influence fail as chips. And we talked about chemical effects options.

So in summary, we've had some extensive analyses efforts, which are ongoing. A re-analyses is ongoing due to new information, new data.

We've had some significant plant modifications. We did remove some Kaowool from IP3. Only IP3 had Kaowool, IP2 did not. So we removed that.

We've done some testing and we participated in the owners group efforts on this issue. We plan on replacing buffers for IP2 for sure and most probably for IP3.

And we're also examining additional chemical effect testing. And that's what Rob is going to talk about right after this presentation.

Of course, we won't mention how much money has been spent on these modifications.

VICE CHAIRMAN BANERJEE: It seems quite small.

MR. IRANI: Well, let's put it this way: If I had 5 percent of that, I would be happily retired.

MR. SMITH: So would I.

CHAIRMAN WALLIS: So are we going to move on to --

MR. CHOROMOKUS: Just keep going?

The lead in was on chemical effects, and I thought I would just give a quick background on what we've done in chemical effects. Not specific or anything at Indian Point, but certainly the decision on which path to go forward on is predicated on some of the past work. So I thought I'd bring it and present to you guys.

Slide 2 --

CHAIRMAN WALLIS: Well, you have to

speak into the mike a bit better.

MR. CHOROMOKUS: I'm Rob Choromokus from Alion.

So slide 2, the outline I will go through today, is short. Go through with WCAP chemical effects tests, a sample of how we do that type of testing.

I think the last time I had met you guys I had described some of the results or observations we saw on the vertical loop. And we had decided to undergo a rate testing to see if we can elevate that condition.

And we also started looking at some more 30 days integrated chemical effects testing. And to support that decision we did a certain amount of benchtop experiments. And then depending on the results of the benchtop experiments and what you see, you may move into head loss experiments.

Slide 3.

A summary of the test performed. We've done two plants with vertical loop experiments. Again, those were just unacceptable head losses with an appreciable amount of chemical precipitate. The fiber bed thicknesses ranged from thin bed to 2 inches. So that loop has been somewhat abandoned.

We have now moved into doing it based on arrays.

CHAIRMAN WALLIS: So you essentially found the same sort of thing that Argonne found?

MR. CHOROMOKUS: Exactly.

CHAIRMAN WALLIS: Right.

VICE CHAIRMAN BANERJEE: Now when you say array tests, that with these arrays of your top hat fuel tests?

MR. CHOROMOKUS: Exactly. I'll show why.

We've done four plants to date and we've had mixed results. And I say the results are mixed in that we achieved acceptable head loss. We started out with latent fiber only, a little bit of particulate, micro therm, plants that we felt had a high probability of passing the chemical precipitate in that they were an eighth of an inch. There would be some screen that would be open.

The next set of plants were a little bit thicker. And, again, these screens tends to load nonuniformly. So although it may be an equivalent, theoretically eighth of an inch. You can get more debris on there and you consequently will have some open area.

And then we did a two inch Nukon debris bed with one plant full particulate load produced high head losses.

Although the data was good --

CHAIRMAN WALLIS: What did you put in this array tank test? What kind of a screen?

MR. CHOROMOKUS: Top hat screens.

CHAIRMAN WALLIS: Top hat screens. These are all top hats then?

MR. SMITH: Yes. Some of them were in a vertical orientation versus a horizontal orientation.

CHAIRMAN WALLIS: Arrays of how many?

MR. SMITH: Two.

CHAIRMAN WALLIS: Two.

MR. CHOROMOKUS: Yes. Unfortunately somebody --

CHAIRMAN WALLIS: So two is the minimum array, I guess. One is --

MR. CHOROMOKUS: Well, there's a reason for that. I mean when we talk about chemical precipitates, I think we're beyond truckloads. We're in tankers. You do run into scaling issues. And I think that's why the folks at CCI decided to go into -- there are probably other reasons. But when you premix these and batch them in, you introduce a lot of volume of liquid. So you try to get the scaling down so you don't have to introduce so much precipitate. So you basically take the scale of the experiment down.

VICE CHAIRMAN BANERJEE: Did they propose alternate methodology to WCAP, right?

MR. CHOROMOKUS: Yes. I'll get to that.

VICE CHAIRMAN BANERJEE: Yes.

MR. CHOROMOKUS: Slide 4. The key observations from the tests were the WCAP precipitates as we form them are very hydrated and very gelatinous and a morphous type. We didn't produce any acceptable head losses in a vertical loop unless there was just a trace amount of precipitate. And precipitates will pass through a bare screen. I've been asked this question many times: What is the open area required? I just have not run enough tests to have that kind of data yet.

VICE CHAIRMAN BANERJEE: Then what do they do downstream is the issue? They pass it?

MR. CHOROMOKUS: That's the next guy in line, right.

VICE CHAIRMAN BANERJEE: Right. The pour inlet.

MR. CHOROMOKUS: Slide 5 is just an example of that tank. As an illustration you'll see the top hats sitting in there vertically.

The next slide will just --

CHAIRMAN WALLIS: Show anything about how you put things in. Presumably you're putting flow in from above in some way in this tank?

MR. CHOROMOKUS: Sparger system when the down pipe comes in --

CHAIRMAN WALLIS: Sparger system?

MR. CHOROMOKUS: Yes.

CHAIRMAN WALLIS: Do you use buckets or do you use something else?

MR. CHOROMOKUS: We started with buckets. We've moved into something a little more elaborate -- trash dump. It'll empty a 55 gallon drum in about 10 seconds.

CHAIRMAN WALLIS: Still a-- of hydrocultural experiment.

MR. CHOROMOKUS: The object is get the turbulence and let the approach velocity and the screen do the work for bed accumulation.

Sample inputs for one test we ran, you can see they're not significant but this is a one-eighth of an inch debris bed. And it is a high particulate to fiber issue.

CHAIRMAN WALLIS: You did a pretty good

job of weighing your paint surrogate to certain significant figures.

MR. CHOROMOKUS: Engineers will be do that.

CHAIRMAN WALLIS: Quite an accomplishment, I'd say.

MR. CHOROMOKUS: Next slide.

These were the precipitates. Based on the WCAP method. And WCAP method does give you a generation curve. You can take it out to 30 days. So what we did is we created batches that represented certain times. So we had all three types of precipitates and we had the quantities measured out for it to be introduced over time.

The next slide, this is just a sample of what they looked like in case you haven't seen them before. This is not the quantities we used. We used quite a bit more.

Next slide.

CHAIRMAN WALLIS: This is as stirred or something, or do they take a long time to settle?

MR. CHOROMOKUS: A long time to settle. We had that question yesterday. We do confirm the settling rates. This was just to get a picture for an earlier distribution.

CHAIRMAN WALLIS: Quite slow.

MR. CHOROMOKUS: Next slide is 9 is the test results during a add. We do a clean flow sweep at the beginning, and that's what you're seeing at the onset there.

CHAIRMAN WALLIS: Why is there so much difficulty controlling the flow rate?

MR. CHOROMOKUS: Oh, the red line up and down?

CHAIRMAN WALLIS: Yes.

MR. CHOROMOKUS: It's just bouncing around. That's actually quite stable.

CHAIRMAN WALLIS: It's because you have a full origin, isn't it? Because that's really you're exaggerating it because you have a false origin.

MEMBER ABDEL-KHALIK: If you look at the scale here --

CHAIRMAN WALLIS: Right. You have a false origin way down below.

MR. CHOROMOKUS: You do see the head loss slowly increasing over time. I can't read the number, but it looks like about 24 hours. Is that right?

VICE CHAIRMAN BANERJEE: It's about--

CHAIRMAN WALLIS: But it's a very small head loss.

So you add debris and the head loss goes -- no the velocity goes way up. Why is that? Then you make a flow adjustment. Why is that?

MR. CHOROMOKUS: I can't see what's going on from the front.

CHAIRMAN WALLIS: The red line is a bit peculiar at the beginning. But maybe it doesn't matter.

VICE CHAIRMAN BANERJEE: Well, it goes from .0121 to .0 --

CHAIRMAN WALLIS: One two seven. It's not--

MR. CHOROMOKUS: Yes, it's not -- looked high on the scale.

CHAIRMAN WALLIS: Yes. Right.

MR. CHOROMOKUS: I think the scale's overly sensitive.

CHAIRMAN WALLIS: So the effect of adding batches doesn't seem to make much difference here?

MR. CHOROMOKUS: No. And I think it's not a very eventual test in that it illustrated that if you have an equivalent eighth of an inch and you have full precipitates, you can potentially get through this with acceptable NPSH margin. Again, those plants that have full fiber loads, they're certainly not in this situation.

CHAIRMAN WALLIS: Now these things are put into this box and stirred, is that how it works?

MR. CHOROMOKUS: Well, they're fully agitated. I mean they're --

CHAIRMAN WALLIS: But is the box agitated? I don't quite understand how things work in terms --

MR. CHOROMOKUS: The illustration you're looking at right there isn't the box that you saw in the IP array.

CHAIRMAN WALLIS: This is just an artist impression or something?

MR. CHOROMOKUS: No, it's just like that.

CHAIRMAN WALLIS: It's real?

MR. SMITH: It's the tank.

CHAIRMAN WALLIS: There's some sort of a baffle plate here? Is there a stirrer?

MR. CHOROMOKUS: That was just to represent --

CHAIRMAN WALLIS: Is there a stirrer in

there?

MR. CHOROMOKUS: There is a stirrer in there.

CHAIRMAN WALLIS: There is a stirrer in there.

VICE CHAIRMAN BANERJEE: This is slide 5.

CHAIRMAN WALLIS: It doesn't show you the stirrer, thought. It doesn't show you how the stuff is put in and -- but it's put in and it's agitated in there?

MR. CHOROMOKUS: Right.

MEMBER ABDEL-KHALIK: Is the stirrer or is just Sparger system?

MR. CHOROMOKUS: There's a Sparger system that runs down to the bottom to kick things up. And there's also a sophisticated trolling motor in there to keep --

MR. SMITH: Electric trolling motor, I'll say, to keep things moving.

MR. CHOROMOKUS: The object is to get it all in suspension so it can attract to the screen.

CHAIRMAN WALLIS: So it looks like quite a lot. I mean, 9 kilograms of thermal lag and 15 kilograms of paint. There seems to be quite a bit of stuff in there.

MR. CHOROMOKUS: There is. The next photo, 10, shows the murky systems. And it never really did clean up.

CHAIRMAN WALLIS: And this is during the test?

MR. CHOROMOKUS: During the test.

VICE CHAIRMAN BANERJEE: This is the liquid then?

CHAIRMAN WALLIS: This is the surface you're looking at? Something is floating on the surface?

MR. CHOROMOKUS: Paint chips.

CHAIRMAN WALLIS: Ah-ah.

MR. CHOROMOKUS: At the end of this experiment we put paint chips in to see how they performed relative to a plant that had --

CHAIRMAN WALLIS: Now you have top hats with three rings instead of two rings?

MR. SMITH: Yes. We have a triple.

CHAIRMAN WALLIS: This is a different --

VICE CHAIRMAN BANERJEE: This doesn't have any stuffing in between?

MR. SMITH: Yes. No, that one does not.

MR. CHOROMOKUS: This one did not.

MR. SMITH: Did not, yes. It was a low fiber plant, so they had little concern of fiber bypass.

CHAIRMAN WALLIS: I don't see much stuff stuck on the outside of the screen. Where did it all go?

MR. CHOROMOKUS: Well, when it drains down, it tends to fall off.

CHAIRMAN WALLIS: Where does it go?

MR. IRANI: Next slide.

MR. CHOROMOKUS: Next slide. When we drained down, they were all covered, obviously, with the micro therm, which is the brown --

CHAIRMAN WALLIS: So it more towards the bottom of the tank that this stuff --

MR. CHOROMOKUS: When you drain down.

MR. SMITH: When you drain down the stuff will fall off.

CHAIRMAN WALLIS: Essentially all the material gets stuck on the screen then? There's very little that's left in the tank.

MR. CHOROMOKUS: It's either stuck on the screen or it's passing through.

CHAIRMAN WALLIS: Okay.

VICE CHAIRMAN BANERJEE: In this case

having this low bypass material in the screen might make quite a bit of difference.

MR. SMITH: We run it with them in there to --

VICE CHAIRMAN BANERJEE: You've done that?

MR. SMITH: It's been run that way, yes.

VICE CHAIRMAN BANERJEE: Because this one doesn't have it.

MR. CHOROMOKUS: This one didn't have it.

VICE CHAIRMAN BANERJEE: But does that make a difference? Because that material doesn't with the chemicals --

MR. SMITH: We've seen some difference. It's not like it dramatically fails or anything. But we've seen a little bit of a difference. What happens are the bypass material, the stainless steel mesh, appears to be capturing fibers that sneak through the perforator plate holes. Those fibers then will collect the particular that's sneaking through. So you end up building little pieces of bed down in our mesh. Your choice would be it be going downstream versus being caught there.

CHAIRMAN WALLIS: Now what I see in the

next two slides looks more paint chips than fibers, presumably.

MR. CHOROMOKUS: Again, this was a latent fiber. It was only the equivalence of one-eighth of an inch, so there isn't a lot of fiber. And that's why we --

MR. SMITH: This plant was all RMI, it has no fiberglass insulation.

CHAIRMAN WALLIS: But I thought there was something else here that was put it. Feltlag surrogate, isn't that fiber?

MR. SMITH: For the most part it's particulate. We did add a little bit --

CHAIRMAN WALLIS: Mostly particulate.

MR. SMITH: We did add a little bit of fiber. It does contain some fibers.

CHAIRMAN WALLIS: So doesn't quite a lot of stuff go through this screen?

MR. SMITH: Absolutely.

CHAIRMAN WALLIS: And do you check that somehow? Presumably you weigh what you've got on the screen and what you put in, and the rest went through or something like that?

MR. CHOROMOKUS: No. Because we wouldn't know how to weigh --

CHAIRMAN WALLIS: Do you know how much went through?

MR. BASKIN: For downstream evaluations we're treating as if particulates go through the screen.

MR. SMITH: Particulates go through the screen, fibers do not.

MR. BASKIN: There's no way to stop the particulates.

CHAIRMAN WALLIS: So the basis of the test was you're scaling in some way what you expect to see in some particular event?

MR. CHOROMOKUS: You basically start with the full array and a unit load per area.

CHAIRMAN WALLIS: Right.

MR. CHOROMOKUS: You scale down.

CHAIRMAN WALLIS: For some particular event that's calculated.

MR. CHOROMOKUS: Right.

CHAIRMAN WALLIS: and then --

VICE CHAIRMAN BANERJEE: This is a different -- this was done at a different plant?

MR. CHOROMOKUS: Yes.

MR. SMITH: Sure.

CHAIRMAN WALLIS: Oh, okay. So this is

just an example of the kind of work you do?

MR. CHOROMOKUS: Exactly.

MR. SMITH: Well, to let them know which direct do we want to recommend going.

MEMBER ABDEL-KHALIK: It's hard to believe that this debris bypassed the eliminator and would have a minor effect in an experiment --

MR. CHOROMOKUS: It -- sorry.

MR. SMITH: We've measured. We've run some tests recently with and without, and it had some effect.

COURT REPORTER: Excuse me. Can you speak into the microphone and identify yourself?

MR. SMITH: Oh, I'm sorry. Sorry. Yes, this is Arron Smith.

But, yes, we've run with and without the bypass eliminator and it has some effect. And it depends on flow rates, et cetera.

MEMBER ABDEL-KHALIK: Do you have a quantitative estimate of how much that effect --

MR. SMITH: Increase in head loss?

MEMBER ABDEL-KHALIK: Right.

MR. SMITH: I don't know. What was it running.

MR. BASKIN: About a half foot.

MR. SMITH: Yes, one foot, maybe increase, half a foot increase for one of our plants. We have not run with chemical effects at Indian Point. All the Indian Point where the bypass eliminator is in place for all of our testing always. We have run some with and without to see differences. But for all the head loss testing that was conducted for Indian Point and our past clients that had a fiber load that wanted the bypass eliminator, all the tests and the testing were run with that mesh behind the perforated point.

VICE CHAIRMAN BANERJEE: At Indian Point even with the alternate break methodology will have maybe reduced fiber loads, but will still have fiber?

MR. SMITH: Correct.

VICE CHAIRMAN BANERJEE: So I mean it's hard to know exactly whether to put this bypass -- sorry. You tested, or if you do test it, you'll test it with the bypass eliminator, right?

MR. SMITH: That's correct.

MR. CHOROMOKUS: Keep going?

CHAIRMAN WALLIS: Yes, keeping going, please.

MR. CHOROMOKUS: Let's just up ahead to

the next slide.

Sot he results were and the recommendations would be for those plants that have and they're sharpening their pencil to get down to a relatively thin bed, this is perhaps an acceptable way or could provide acceptable results in terms of head loss using the WCAP method. However, for those plants that have heavy fiber loads, which we have a few, it may require a refined method. And you've heard a lot of consternation, I guess, in the last couple of days about where can we take this going forward.

So the next slide is to go back and take a look at where can we refine the model or refine what's happening. And we needed to assess the impact of the chemical environment on the debris head loss. That was the objective. And try to incorporate all three phenomena; corrosion, leaching of materials and then a solution, participation and then your effect on head loss. So we're going to combine all three into a single event and more replicate the actual phenomena as it would happen in the plant over that 30 day period.

Next slide.

So we're proposing to perform refined

test to integrate these three concerns, corrosion, participation and head loss by designing a vessel--

CHAIRMAN WALLIS: The refined test means one that meets Professor Banerjee's criteria for being excellent? Is that what you mean by "refined"?

MR. CHOROMOKUS: I think refined means more expensive sometimes.

CHAIRMAN WALLIS: It means more expensive.

MR. CHOROMOKUS: It is, you know, we're trying to bring time and three phenomena together. So I'm not sure if that definition works. But we're going to try to more closely replicate the conditions in the precipitate formation.

MEMBER ABDEL-KHALIK: But even though this is going to be a three day -- a 30 day test, the intent is to deposit all the debris at times zero?

MR. CHOROMOKUS: No. We're going -- it's acknowledged the precipitates grow over time through dissolution and precipitation.

MR. SMITH: Chemical precipitates.

MEMBER ABDEL-KHALIK: Right.

MR. CHOROMOKUS: So we needed to take that into account. Because at the beginning of the event when our NPSH margin is low, perhaps the chemical impact is negligible. And then over 30 days when the chemical impact load could be high, we had seen we'd have 20/25 feet of margin. So how do we bring that into the equation?

CHAIRMAN WALLIS: So you're trying to simulate the whole events in the first 30 days?

MR. CHOROMOKUS: Exactly.

CHAIRMAN WALLIS: Series of events. And in some experiment?

MR. CHOROMOKUS: Exactly.

So we have a loop. We have actually two sets of loops. One loop -- they both are able to control flow and temperature. However, the limit is about 200 degrees Fahrenheit, so we need to account for those conditions that may go over 200 degrees. There is a 12 hours -- 24 hours where time is greater than the loop can accommodate. So we also need to account for that leaching that may occur in that time period.

CHAIRMAN WALLIS: And these loops are going to have top hats in them?

MR. CHOROMOKUS: Nope.

CHAIRMAN WALLIS: No?

MR. CHOROMOKUS: The first loop -- the

smaller loops, the scale could not just support a large top hat. If we -- the smaller loops which you see -- you're obviously running ahead. But the small loops have small flat plates in them. So what they're going to do is measure the delta p, the change in bed morphology. And then we would apply that change in bed morphology to the results that we use in the array.

CHAIRMAN WALLIS: And you assume you can do that?

MR. CHOROMOKUS: I'm assuming for now I can do that.

CHAIRMAN WALLIS: Oh.

MR. CHOROMOKUS: The larger loop that you see, it has a larger screen. That could be modified to --

CHAIRMAN WALLIS: It just has a flat screen?

MR. CHOROMOKUS: It has a flat screen now? So it could be modified for a shape.

CHAIRMAN WALLIS: So you're not just building something which you can sort of scale directly to a plant? You're building something so in between a very fundamental experiment and a full scale or a representative plant type test; you're doing something in between here which then has to be interpreted in a way when you're going to say what this means for a plant?

MR. CHOROMOKUS: Well, the plant conditions will all be represented in the experiment with the exception of --

CHAIRMAN WALLIS: It won't look like anything in any plant?

MR. CHOROMOKUS: Exactly. It'll be a unit area screen.

CHAIRMAN WALLIS: Right.

MR. SMITH: These test loops already exist. They're in existence --

VICE CHAIRMAN BANERJEE: The reason you're doing this is you think that putting a surrogate in with your reduced fiber load will lead to higher pressure loss?

MR. CHOROMOKUS: Sure. We've seen that.

VICE CHAIRMAN BANERJEE: Yes. So in fact -- but then the Swiss experiments where you didn't have the surrogate but you generated, their experiment could be open to some problems because they didn't mix the inlet closely. They had some bare areas on top?

MR. CHOROMOKUS: Sure.

VICE CHAIRMAN BANERJEE: So it was -- we don't know if that's true or not that they would get acceptable pressure drop. But you feel that in your case that if you tried that experiment with the surrogate, it would just give you too high a pressure loss?

MR. CHOROMOKUS: If we're going to maintain the premise that everything is fully entrained and surrogates are where solution is and debris is where solution is, which is going through the screen, then I see a pressure drop.

CHAIRMAN WALLIS: It seems to me you're trying to get the plant conditions in terms of temperature and chemistry.

MR. CHOROMOKUS: Temperature or pH, flow.

CHAIRMAN WALLIS: And debris and so on. But your fluid mechanics conditions are going to be very different from anything in any plant. So I just wonder what you're going to do with the results?

MR. CHOROMOKUS: Well let me keep going on that.

CHAIRMAN WALLIS: You're keep going?

MR. CHOROMOKUS: We're going to create-- let me get up here. So obviously the facilities you fully understand, so we can get to some questions in the back. So let me go to slide 17 real quick.

We have facilities: A small scale/large scale. Large scale will contain all the materials. It will contain pool volume and will preserve pool volume to surface area of the materials so that we get the correct leaching of materials in dissolution. We'll run the temperature transient and the pH transient consistent with the plant. And then we'll also have a screen that's sized consistent with that pool volume, has the same debris bed thickness and constituency as a unit area of the screen of the plant.

CHAIRMAN WALLIS: Yes, but do you do you design the strainer as a result of all this?

MR. CHOROMOKUS: Sorry?

CHAIRMAN WALLIS: You're going to redesign a strainer as a result of all this or is it--

MR. CHOROMOKUS: No. The intent is to show that the head losses are virtually -- they increase by a minuscule amount.

MEMBER ABDEL-KHALIK: But the changes over a 30 day period really pertain to the change in bed morphology during that entire 30 day period?

MR. CHOROMOKUS: I would agree with that.

MEMBER ABDEL-KHALIK: And that, to a large extent, is effect by essentially the flow conditions.

MR. CHOROMOKUS: We have the flow conditions modeled.

MEMBER ABDEL-KHALIK: Not necessarily.

MR. CHOROMOKUS: The approach --

MEMBER ABDEL-KHALIK: And not just the flow conditions, but also the changes in concentrations, the changes in the actual debris content with time and it would be very difficult to make that translation from your experiment to an actual plant or duplicate what actually happens.

MR. CHOROMOKUS: I'm not sure I understand the concerns. But if we are creating a chemical reactor here and all the inputs are there, and I'm flowing water around those materials and I'm pulling water through a debris bed at the same velocity that I'm pulling through in the screen in the plant, the bed morphology should change the same way.

MR. SMITH: And it's the same to rebed. Same particulate, same fiberglass that's all on our strainers.

MR. CHOROMOKUS: It would be the same as taking the ice tea test and hooking DP measurement to it for the rebed.

MEMBER ABDEL-KHALIK: But can you actually show the change in bed morphology over a 30 day period will replicate what actually happens in a plant?

MR. CHOROMOKUS: What would be missing? I mean, the deposition of aluminum would occur, the corrosion in the aluminum, the deposition, dissolution in the silicon from the fibers is all occurring in this experiment. The bed morphology is changing as a result of the chemistry.

MR. SMITH: Yes. The silicone that's predicated to occur to tie up with the aluminum that cause these particulates are coming out of the fiberglass that's all in our strainers.

MEMBER ABDEL-KHALIK: I guess I'll have to think through this.

VICE CHAIRMAN BANERJEE: Well, the issue really is that a lot of these plants may end up taking some credit for inhibition of dissolution based on the correlations that we saw.

MR. CHOROMOKUS: Sure.

VICE CHAIRMAN BANERJEE: I mean, whether this will stand scrutiny is open to question. But nonetheless, that's a methodology. We've got a corrosion rate now. They've got an inhibition rate. And therefore, you can calculate the dissolution rate based on inhibition taking into account silicone is also dissolving.

MR. SMITH: Exactly.

VICE CHAIRMAN BANERJEE: So you can do this. Theoretically what you are trying to really do is simulate that on some scale. But let's give the -- if we accept -- I've forgotten what the number of that report is, but the dissolution rates and so on that they have there. Then you have some protocol that you could follow in introducing the precipitate at whatever rate is given out of those exercises into your large experiment, right? So that you add it altogether, right?

MR. CHOROMOKUS: That would presume I knew the form of the precipitate.

VICE CHAIRMAN BANERJEE: Well, you can add the surrogates certainly, or something.

MR. CHOROMOKUS: I don't like the surrogates. The surrogates seem problematic to me. So --

VICE CHAIRMAN BANERJEE: You mean any surrogate is going to give you problems, however small?

MR. CHOROMOKUS: Well, the ones that we use, you know, for mixing the WCAP, using that WCAP method, it may be the correct compound but it may not be the correct form. So I haven't run the 30 day test yet, but indications would be and I guess some benchtop experiments here would be that the corrosion is occurring, the deposition is occurring on the fibers. Like rust on a bumper that fiber is degrading. However, it's remaining porous; I could still pass water through it. If I could pass water through it, I can potentially achieve an acceptable DP.

MR. SMITH: It's actually a mass balance that's going on, too.

VICE CHAIRMAN BANERJEE: Yes, the silicone is coming off the pipe and --

MR. SMITH: Exactly.

VICE CHAIRMAN BANERJEE: -- everything, whatever at the same time and the local location.

MEMBER ABDEL-KHALIK: But from the flow conditions--

VICE CHAIRMAN BANERJEE: It's a path,

yes.

MEMBER ABDEL-KHALIK: -- you may actually be able to replicate the average conditions in a filter. But how much variation is there within a single filter unit?

MR. CHOROMOKUS: Variation on velocity or variations on --

MEMBER ABDEL-KHALIK: Flow conditions.

MR. CHOROMOKUS: Well, we idealized the conditions, as somebody said earlier. It's approach velocity is flow divided by area. So we're going to idealize it as an average approach velocity. It may be higher in certain areas --

MEMBER ABDEL-KHALIK: But looking at some of the pictures we've seen earlier, there is a great deal of variability of that thickness at different locations within the same filter.

MR. SMITH: Correct. And that will usually produce lower head losses through the filter system versus putting a uniform debris bed across the filter. We've done many calculations and it has to do with the internal losses in the strainer. But, yes, applying a uniform debris bed across your strainer will produce a higher head loss. We've done this multiple times.

MEMBER ABDEL-KHALIK: Could you repeat that again, please?

MR. CHOROMOKUS: I mean,that's why we have the issue none of us like flat plates so much. So we all have a series of flat plates, but we've bent them in shapes that draw different velocities through them, therefore thereby getting a non-uniform deposition of debris and overall, a lower head loss. Otherwise we would take all of our strainers and assume the same approach velocity and it would be a uniform deposition and we'd just apply 6224 and we'd have a tool. But we do get differences in approach velocity throughout the entire length through every surface.

VICE CHAIRMAN BANERJEE: You're really proposing to do a piece of -- not fundamental, but something quite a long way from proof testing something here.

CHAIRMAN WALLIS: I was wondering what the output from this is going to be that helps the licensee. What are you going to do for the licensee? And this may be interesting stuff, but is it going to give an output that is useful for the licensee?

MR. CHOROMOKUS: I think for plants that

have, you know like I said, a large debris bed or a thick debris bed if you can characterize the behavior or what's happening in the debris bed, characterize the change in porosity and apply that as an adjustment to the head loss in a non-chemical effects test, that would be a way through this.

CHAIRMAN WALLIS: But they're still going to have to do tests to prove that it works?

MR. CHOROMOKUS: Well, they've already done the array tests that prove that in a nonchemical. In a chemical you'd put that, like I said, that representative debris mixture on there and find out the change in porosity, the change in DP and conservatively apply that to the entire array.

VICE CHAIRMAN BANERJEE: I guess your argument is is as the silicone leaches out and then -- sorry. As the silicone leaches out and inhibits the solution, it adds to the porosity of the fiber and therefore you gain some flow through --

MR. SMITH: The silica also, you know, combines with the aluminum and produces the actual particulate material. So it's a mass balance kind of--

CHAIRMAN WALLIS: Both disappears and

builds up something else, doesn't it?

VICE CHAIRMAN BANERJEE: Yes. Something else.

CHAIRMAN WALLIS: Where do you want us to look?

MR. CHOROMOKUS: Sot he benchtop experiments -- sorry. On page 23 or actually 22.

We were focusing on one of the more friendlier environments, and it's Nukon and TSP, or Mineral Wool and TSP. We're not attacking alkaline, high alkaline pHs yet or high pHs yet. TSP, I think the NUREG 6915 the result of the Argonne work quoted for those plants that have low dissolved calcium with TSP, generally you have a minimal chemical effects. I wanted to figure out a way to prove that, because that work was just started in that NUREG, but it wasn't finished.

So we did a series of experiments, benchtop experiments with TSP solution, buffered solution and with aluminum and then with Nukon. And what we found was certainly that the phosphate inhibits the corrosion of aluminum. It would come up to a certain concentration and then flatten out. And I think Tim's work or Westinghouse's work confirms that as well.

CHAIRMAN WALLIS: Well here it even seems to decrease in this figure.

MR. CHOROMOKUS: Exactly. Now when you add Nukon to it, it goes up just like it would normally, but then it drops out. So what's happening? The aluminum is coming back out of the solution, it's going somewhere. We didn't see any visual --

CHAIRMAN WALLIS: Aluminum silicate or something?

MR. CHOROMOKUS: It's forming aluminum silicate on the surface of the fiber.

Next slide.

CHAIRMAN WALLIS: Yes, but this has to lead to some microscopic property which is useful for predictive purposes.

MR. CHOROMOKUS: Okay. But you can see the fibers, or the first two weeks they would remain virtually unchanged.

CHAIRMAN WALLIS: Yes.

MR. CHOROMOKUS: And, again, the first two weeks of the event is our challenging time. The first 24 hours is our challenging time from an NPSH standpoint. As we move two, three, four weeks into the event you start to see the deposition of the aluminum in this silicate formation.

And when I capture that, there's still porosity in that bed. That bed will still pass fluid.

VICE CHAIRMAN BANERJEE: But if the first 24 hours is critical, you don't get that margin just by using these Westinghouse correlations for dissolution rate and inhibition rate?

MR. CHOROMOKUS: They ramp up quite quickly in the first 24 hours. It doesn't take much to go -- a little goes a long way with that kind of material. But certainly we've looked, in the first experiment I showed we did calculate the time-based precipitate formation.

VICE CHAIRMAN BANERJEE: Well, it looks like things ramp over --

MEMBER ABDEL-KHALIK: How do you demonstrate conservatism of any calculations that would be derived based on your experiments?

MR. CHOROMOKUS: That's an extremely good answer, and we've been talking with the Staff about this approach. And we've got a test plan. In fact, we're doing some testing right now.

Selection of the pH, the transient, the input parameters are key to ensuring you're running a bounding test. And that is the challenge is to not only set up the experiment where you're maximizing or trying to find the worse case, the conservative case, but then we believe -- believe -- we apply the results, there'll have to be certainly a sound technical basis or conservative basis for applying the results to the nonchemical array.

I'm still in this phase of the four phase project. So the application of the results is certainly something that will introduce, I believe, another level of conservatism. But the selection of the input parameters is key right now for ensuring a conservative experiment for 30 days since it is resource intensive.

I mean, we have six loops you can run six different ways, six different buffers, six different beds, vary six different temperatures or pH in the event to somehow develop a -- I don't want to use the word correlation, but develop a bounding case. But then you would take those results and conservatively apply to the nonchemical array.

CHAIRMAN WALLIS: Can we go to the conclusions here?

MR. CHOROMOKUS: These conclusions were really the results of the benchtop program. And I already stated them.

So slide 26 is where we're going with the program is to take care of through a benchtop program which confirms initial reactions, addresses high temperature limitations of the test tank, validate materials that we're going to put in as surrogates. We actually can't get dirt and dust from a containment. It has to be a surrogate. And that any new materials or conditions we certainly do in a benchtop experiment.

Thirty day integrated testing that I just discussed. Starting right now the first tests are to include basically Nukon and Mineral Wool in a STP environment. And the second batch is to take care of Nukon, Cal-Sil in a tetraborate environment.

To be continued.

CHAIRMAN WALLIS: Okay. You finished? Any further questions.

VICE CHAIRMAN BANERJEE: Well, I have a question for you. I mean, is this a program you are contemplating or is this dependent -- at any point?

MR. IRANI: Yes. We have a proposal on the table right now.

VICE CHAIRMAN BANERJEE: They're looking at it?

MR. IRANI: Yes.

VICE CHAIRMAN BANERJEE: And you're looking at this as a potential way to solve your chemical interacts?

MR. IRANI: Yes, here's what's happening for us right now. We don't have that much aluminum, submerged aluminum. We have a very small quantity, equally small quantity exposed to spray. There is a certain quantity that is coming out of the insulation. So the total sodium aluminum silicate is like 37 kilograms. Unfortunately, you know every kilogram of aluminum is multiplied by a factor of ten with precipitates out because of the chemical composition.

So the WCAP model right now is releasing all of the aluminum in 12 hours for us. As it releases the aluminum, it's forming the precipitate instantaneously. So all our precipitate is formed at 12 hours.

So we need some relief from that because we have the two sumps. And so if we can stretch it out to 24 hours or even much than that, the longer you go the precipitate builds up, the less flow you need. Because all you're doing is boiling off in the core and so you have more NPSH margins. So as a function of time if the precipitate builds up, it's much beneficial to us to solve this issue.

And I think what may happen here is that we've done the debris head loss test and now we do the chemical tests and it's going to be on a flat screen. And maybe that's some sort of a bump up factor that we'll apply to our degree head loss to put this thing to bed.

CHAIRMAN WALLIS: Well, the simpler your explanation can be at the end, the better.

MR. IRANI: I agree.

VICE CHAIRMAN BANERJEE: It would be nice if you can just dump this and it works?

MR. IRANI: Yes.

CHAIRMAN WALLIS: Right.

Any more questions?

I'd like to take a break until 3:20. And then hear from the Staff. And we'll do that.

Thank you very much for your presentation.

(Whereupon, at 3:08 p.m. a recess until 3:21 p.m.)

CHAIRMAN WALLIS: Please come back into session. We're now going to hear from the Staff as the final and most spectacular and best presentation of the day.

VICE CHAIRMAN BANERJEE: It's only words, right? No graphs?

MR. WHITNEY: No graphs.

Good afternoon. I'm Leon Whitney. I'm with Ralph Architzel and Dr. Shanlai Lu. We've all been team leaders of the Generic Safety Issue 191 plant audits. Our purpose is to give you an update on those audits.

The purpose of the audits is threefold:

To obtain sample information to assist in verifying the adequacy of the fleet performance of the GL corrective actions;

To increase the efficiency and effectiveness of efforts of the licensees by providing technical lessons learned for PWR licensees and their vendors and contractors, and;

To identify issues early to promote timely, uniform and consistent issue resolution, and a stable regulatory environment.

The next slide.

Schedule. There have been five audits conducted up through Oconee to date. And as you can see, Waterford is in June. And the next page we have four more scheduled.

CHAIRMAN WALLIS: Well, how about D.C. Cook?

MR. WHITNEY: D.C. Cook we have not been to and do not plan to go to at the present time.

CHAIRMAN WALLIS: You haven't been to D.C. Cook?

MR. WHITNEY: No, sir.

And our audits end with St. Lucie in January of 2008

Next slide, please.

Audit conclusions to date. The Staff has a high confidence that low fiber, low chemical plants can adequately demonstrate compliance with some open items identified. And those will be responded to.

MEMBER KRESS: Do you have definitions for what you mean by low fiber and low chemical?

MR. WHITNEY: Numerical? No. There is plants line Oconee where there's almost no fiber in their containment. And --

MEMBER KRESS: It would be obvious to you when you look at the plant, the low fiber?

MR. WHITNEY: You can look at the loads and there were some high fiber plants discussed today.

CHAIRMAN WALLIS: What is the basis of this first bullet here?

MR. WHITNEY: Well --

CHAIRMAN WALLIS: Is that just a hope?

MR. ARCHITZEL: Let me. Just going with Oconee just for an example for a second. I was a team leader on that one. Basically they don't have any fibrous insulation at all. They've removed it all. They got --

CHAIRMAN WALLIS: So this just applies to the low fiber? It's only when you have low fiber.

MR. ARCHITZEL: Yes. This is low fiber slash low chemical.

CHAIRMAN WALLIS: Okay. So if there are no problems, then everything is going to be all right. It's sort of a circular thing in a way?

VICE CHAIRMAN BANERJEE: How many of the plants are like that?

MR. ARCHITZEL: Well, for the two I did, Prairie Island -- but Prairie Island might be questionable. Prairie Island comes close to the one-eighth inch that you heard earlier today. So it's low chemicals, the question on Prairie. But they're close to being there, too. So those two were basically only reflective metal insulation and only latent fiber.

CHAIRMAN WALLIS: I know Cal-Sil?

MR. ARCHITZEL: And in case of Oconee, very large screens like 5,000 square feet. And in the case of Prairie Island, smaller so Prairie Island's okay.

CHAIRMAN WALLIS: And maybe no Cal-Sil as well, does that come into it?

MR. ARCHITZEL: No fibrous insulation, no Cal.

CHAIRMAN WALLIS: No fibers. Fibers includes Cal-Sil?

MR. ARCHITZEL: Well, Cal-Sil -- they don't have Cal-Sil.

DR. LU: Just latent debris, I think.

CHAIRMAN WALLIS: Okay.

VICE CHAIRMAN BANERJEE: What about --

CHAIRMAN WALLIS: What's that?

VICE CHAIRMAN BANERJEE: What chemical did they have, Prairie Island?

MR. ARCHITZEL: As I said, Prairie Island, it's not tremendously problematic. But they wouldn't -- there's an in between on those. They're not the ones that we can definitely say low chemical right now. With Oconee we did go over--

CHAIRMAN WALLIS: Nonetheless, they're increasing the size of their screens even though they have no problems?

MR. ARCHITZEL: Yes. And some of the plants that we wouldn't have expected to change for this GSI.

CHAIRMAN WALLIS: They're still doing it?

VICE CHAIRMAN BANERJEE: To make assurance doubly sure, right?

MR. ARCHITZEL: Well, to not to have to answer the questions of having the 80 square foot screens and whether it was adequate or not.

DR. LU: Yes. That's the same thing for the Watts Bar. Large area expects to be have a spare screen. So it's really not an issue for chemical.

CHAIRMAN WALLIS: Okay. Please continue.

MR. WHITNEY: The incomplete status of chemical and downstream effects evaluations prevents a similar conclusion at present for higher fiber plants.

And the NRC expects later audits to reveal more complete sets of corrective actions and justified evaluations.

The role of audits in the issue closure.

In early 2008 we will receive final GL supplemental responses containing three categories of information:

A detailed description of the Generic Letter corrective actions;

Responses to February 2006 NRC requests for additional information, and;

Audit open item responses as applicable if the plant was audited.

The audit results will support Staff conclusions of reasonable assurance that the sump clogging issue has been adequately addressed.

CHAIRMAN WALLIS: So Watts Bar, the audit I looked at for Watts Bar had 12 open items or something. And you're going to go back there? Have you been back there yet?

DR. LU: October open items have to be addressed as a part of their GL submittal to us. So we're --

CHAIRMAN WALLIS: Are you going to go back and audit them again?

DR. LU: No.

CHAIRMAN WALLIS: Oh, you're not?

MR. WHITNEY: We're just going to read what their resolution of the 12 open items.

MR. WHITNEY: We have prepared some backup slides showing typical audit open items, and welcome your questions.

CHAIRMAN WALLIS: Is there anything you particularly you want to emphasize there?

MR. WHITNEY: No. We've gone through and picked some very typical items.

CHAIRMAN WALLIS: Nothing in particular?

MR. WHITNEY: Nothing in particular. But we're welcome to talk about each area.

CHAIRMAN WALLIS: You'd probably like the kinds of questions which we asked in the last couple of days.

MR. WHITNEY: Well, that would be interesting.

CHAIRMAN WALLIS: Is there anything which we didn't ask which you want to bring to our attention?

MR. WHITNEY: Why don't we see what pops up with the actual open items.

VICE CHAIRMAN BANERJEE: Mike's going to tell us what we didn't ask.

MR. SCOTT: I was just going to say we could violate what I usually prefer to do, which is not to simply read slides. But those are just one liners. And why don't we just walk through those, just read them as one liners and they can stop you, As we know the Committee is always willing to with questions.

CHAIRMAN WALLIS: You're going to read a list of open items now?

MR. SCOTT: Yes. Now, that is not an all inclusive list. These are --

CHAIRMAN WALLIS: Oh, is it?

MR. WHITNEY: They can go fast, it all depends.

MR. SCOTT: If you all would rather we didn't do that, that's okay.

CHAIRMAN WALLIS: They have the rest of the slides then?

MR. SCOTT: Yes.

MR. WHITNEY: Yes.

CHAIRMAN WALLIS: Oh, see. So the rest of the slides are the backup. Otherwise you've finished, we'd all go home.

MR. WHITNEY: I'm done, actually.

MR. SCOTT: We assumed that that part

that he has not yet done, is that which you are most interested in, but we didn't know the level of your interest or the amount of time.

CHAIRMAN WALLIS: Maybe we should take a few minutes to read these slides.

MR. SCOTT: Or you can read on your own if you'd prefer.

CHAIRMAN WALLIS: You want to go through them?

MR. WHITNEY: All right. I'm hearing six answers, so I'd appreciate one answer on what you want me to do.

CHAIRMAN WALLIS: Tell us what's important.

MR. WHITNEY: There are findings in many of the areas, and it's hard for me to judge.

CHAIRMAN WALLIS: Well, if you want to talk about these --

MEMBER KRESS: Why don't we read these and ask them as we go? Slide 1, for example, how do you feel about some of the plants redefining the zone of influence based on --

CHAIRMAN WALLIS: Yes, let's do that.

MEMBER KRESS: Yes, stuff like --

MR. ARCHITZEL: Well, let me talk on

that one. I guess, I don't think there's any open items here on redefinition of the zone of influence. So I can talk on that if you want to, because I was responsible for the zone of influence --

MEMBER KRESS: Fifty-five just brings that question.

MR. ARCHITZEL: All right. But you're not asking a specific question that's not related to that open item?

MEMBER KRESS: Yes.

MR. ARCHITZEL: If you want, I'll answer it. But it was more what I heard I heard today like on the -- you remember the safety evaluation. WE increased the zone of influence sort of arbitrarily for two-phase effects. We really weren't sure of the effects, except for Cal-Sil. You heard about Cal-Sil earlier. Cal-Sil was done with two-phrase so it was left there. But what we heard today was sort of -- we weren't sure that there was any rational reason to increase that zone of influence. There was arguments that said it should be smaller when you test it air jets. It should be a smaller zone of influence versus larger because the velocities are smaller.

We just heard that today on the Cal-Sil.

That's the first time we heard the Cal-Sil. It seems very consistent with the testing that was done for the boilers of the air jets in that they have intact blankets and it was not an increase, but in fact a reduction in the zone of influence associated with that testing. So it's consistent.

We still have the ugliness associated with it whether you accept the ANSI standard or not. But I think that would -- another question was raised, are we going to review that. Well, that hasn't come up yet, but that may be being used as you heard also by one of -- Salem, I believe, was that was going to use that. So that would be an item we'd look in in the audit.

But there's nothing that says they're going to send that into us necessarily. So it didn't look -- the safety evaluation allowed resizing in the zone of influence on a particular basis. It's being done for chemicals. We're taking a detailed look at that for the five day. We've got a contract in place to look at that. And it sounded sort of like the work that was done for the boilers.

CHAIRMAN WALLIS: It seems to me what you have a racket effect. One plant manages to use it a bit, so all the other plants will try to go with that. And then another plant will find a way of ratching it down a little bit more, all the plants will want to go with that. And then it's going to keep getting smaller.

MR. ARCHITZEL: Well, they need it. But there wasn't a strong basis for increasing it in the first place is the point I'm making.

CHAIRMAN WALLIS: And you're going to very carefully examine these experiments --

MR. ARCHITZEL: I didn't say that.

CHAIRMAN WALLIS: -- blanket and see what happens.

MR. ARCHITZEL: I didn't say that. What I said was we don't know. We're carefully examine the coating zone of influence. For this zone of influence there will be an audit with a plant that's using it. We haven't heard it until day. That audit, we'll look at that and decide and what they need. Whether there's a safety evaluation. They don't even necessarily need to send that material in. We're not sure of the level of detail that would be sent in. But what I heard today was consistent with what was done for the boilers. And, you know, that's all I guess.

You asked for my reaction to what I

heard today.

MEMBER KRESS: Yes. Thank you. Appreciate that.

MR. WHITNEY: The asked the important findings. If I could change that question to -- Leon Whitney.

CHAIRMAN WALLIS: She doesn't know which mike switch?

COURT REPORTER: Can you tell from the mikes who is speaking? Oh.

MR. WHITNEY: You asked what was important, if I could change that question slightly what's quite interesting.

This first finding in debris generation ZOI is a little different than the ones you've been talked to about. It's a break within the reactor vessel annulus of the plant. Now that's a constricted break. The pipe is not allowed to sheer--

CHAIRMAN WALLIS: That's what we heard about this morning, right.

MR. WHITNEY: And also you have not only unique plume shape, but you're going to have shadowing or not in the annulus on the other side. Obviously the annulus in some sense would tend to conduct around either side, but it is open at the top. And it's an interesting problem for the licensee to answer the open item as to what really happens and what insulation does get affected on the other side.

CHAIRMAN WALLIS: Not anything on slide 9?

Anything on slide 10?

Those coatings have been a bit of a question all along. Is that being sorted out now. EPRI did some work on coatings. And are you happy now that you can tell what the zone of influence should be for coatings or is it still pretty much up in the air.

MR. ARCHITZEL: The zone of influence, that's what I was mentioning before. We do have a contract. Paul can talk to it. But we have a --

MR. WHITNEY: Come on, Paul.

MR. KLEIN: Paul Klein.

There are two reports in house that the Staff's reviewing relating to reducing the zone of influence of coatings. And that work remains to be done.

CHAIRMAN WALLIS: That's it?

MR. WHITNEY: Testing, EPRI testing.

MR. KLEIN: Well, I guess another area of interest to the Staff with respect to coatings is whether visual assessment is an adequate criteria in order to determine whether coatings will remain in tact after a LOCA. And industry has undertaken program to go out to various plants and perform whole tests to determine the adhesive strengths of different coatings. And that program is winding down. Staff is reviewing that as well.

CHAIRMAN WALLIS: What do coatings do if they get through the screen and go into the core, and the core is hot? Are they likely to stick to the fuel elements or what? Do you have any idea what happens when paint gets put into a core?

MR. KLEIN: It probably would depend on the type of paints since there's various paints in containment.

CHAIRMAN WALLIS: Is this something you're investigating?

DR. LU: If you have the strainer there, that should function as filter, right?

CHAIRMAN WALLIS: Strainers don't --

DR. LU: So the coating chips were never end up being inside the core.

CHAIRMAN WALLIS: You're relying on the

WCAP of some sort to resolve this?

MR. SCOTT: Yes. Mike Scott.

I believe that the soon to be received in vessel effects, WCAP will be address that issue.

CHAIRMAN WALLIS: Are they doing experiments with coating slurries, cooling hot rods? I bet they're not.

MR. SCOTT: That I do not know at this point. We will be able to answer that question next time we see you.

CHAIRMAN WALLIS: Oh, okay. But it's a question that might be on your mind as well?

Anything more on coatings or should we move on to latent debris? Latent debris seems to be what's happening as everyone's cleaning up the plant and it's getting cleaner and cleaner and cleaner. So soon then there will be almost no latent debris left.

MR. ARCHITZEL: And that's only important for those low fiber plants.

CHAIRMAN WALLIS: It's not very important anyway?

MR. ARCHITZEL: It's important for the plants that are --

CHAIRMAN WALLIS: If it's the only fiber

they've got?

MR. ARCHITZEL: Right. So it's critical for them.

CHAIRMAN WALLIS: It seems to be getting smaller and smaller. Every time we hear there's less and less of it. It doesn't look like a critical issue.

What about this: Upstream design. Are you looking at some of these barriers that they're putting in to catch debris upstream and giving them credit for that?

MR. WHITNEY: I haven't reviewed a plant that's stuck in a barrier like that. But, sure, it's structurally sound.

CHAIRMAN WALLIS: And they can justify it somehow.

MR. ARCHITZEL: That's looked at in the upstream analysis by the auditor of each team where they're not up upstream restrictions and things like that that does get examined. Or in the case of areas for transport, that's looked at by the transport auditor. So we have looked at that area in these various audits.

I mean, you don't want to have the refueling pool fill up with water. That's all the water they've got.

CHAIRMAN WALLIS: Debris transport. And CFDs. How about CFDs and tumbling velocities?

MR. WHITNEY: We've been looking at that where they've done one. And John can answer.

CHAIRMAN WALLIS: John? That's John's expertise?

MR. WHITNEY: I don't know who else has done it. John's been the principal along with Ruth Reyes if you got questions on that.

VICE CHAIRMAN BANERJEE: Well, the issue that we brought up to CFD was while it might be reasonably accurate -- accurate for velocities, it was hard to justify any reduction in debris transport because so little is understood about settling in fluids. So what --are licensees claiming some benefit?

MR. ARCHITZEL: The SE does allow it. We do allow it in the SE.

MR. LEHNING: This is John Lehning of the NRC Staff.

We recognize some of the points that you've made about CFD. The way that that's used for these evaluations is to try to bound those uncertainties with conservatisms. And some of the conservatisms are these use of incipient tumbling velocity metrics to decide when the debris is going to transport. That incipient transport velocity means that's when the first particle of debris begins to move away at a certain velocity as opposed to a bulk velocity when, you know, 50 percent of it or 90 percent of it is going to move. And so there are various conservatisms that go into those calculations in order to get credit in settling.

VICE CHAIRMAN BANERJEE: Yes. The problem, of course, is where is that .16 feet per second, for example. I mean, there things depend on the sheer rate of the bottom as to whether they can tumble or not.

MR. LEHNING: Yes, that's true.

VICE CHAIRMAN BANERJEE: It may not even be a good criteria.

DR. LU: Yes. That's the reason we had this open item. When licensee's select this number, we do not see what is the justification for that. So the number for 0.16 foot per second -- so that's the reason we ask for what's the rationale there.

CHAIRMAN WALLIS: Some of average velocity. Because I mean if you have a vortex which do nothing but go around, presumably the average velocity is zero.

MR. LEHNING: Yes. I mean there are different averages or point velocities --

CHAIRMAN WALLIS: In terms of translation velocity.

MR. LEHNING: In the CFD though it looks at that and it looks at over a certain number of cells it'll average it and print that out on the pots, I guess, you get a result. And so we're not talking about averaging over a big area, just a small area of a couple of cells or like was said earlier, 25 cells or 5 cells.

VICE CHAIRMAN BANERJEE: My concern is that, you know, the state of the art in something has to be sort of at a point where there can be reasonable assurance that you're getting a decent result. And in this -- I'm not just talking about tumbling velocities and things like that. I'm talking about it more broadly in separation of particles and settling of particles and transport of particles and other bits.

It's not really a state-of-the-art today even for really higher resolved simulation or whatever you want to do, which they can't do obviously for containment. The state-of-the-art is not such that you can have confidence that you'll get the right fractions being transported or not, you know, or either way. It's not very clear.

But I do know that turbulence will hinder settling enormously. I mean, there are experiments on this where you use particles in a turbulent fluid. And the tumble velocity is extremely low if there at all. And they are much denser than the fluid.

MR. LEHNING: Right. And we recognize that, too. And we've run a few sensitivity cases with different models of turbulence and viscosity. And the results can be slightly different based on those different modeling assumptions that go into it. And if you're talking about large eddy simulation, we haven't -- we don't have the ability to run those in a feasible time frame. But I'm sure you'd come up with a different answer still. But our bottom line is that we feel that the way that we use those to compute flow facilities and the assumptions for the metrics that we use are still conservative based on the fact of using these incipient velocities. And we're not trying to physical model things like settling of the particles. Those particles aren't part of the simulation and it's just the fluid flows and using these metrics that were determined based on testing.

VICE CHAIRMAN BANERJEE: All right. Well, do you have some sort of a write up on this at the moment of what, let's say, you feel is the allowable state-of-the-art? Or is it in an SE or something somewhere?

MR. LEHNING: Yes. The NRC safety evaluation on the NEI guidance has criteria there for computational fluid dynamics codes. It is a little bit limited, but there is also an example Staff CFD run that was run for our volunteer plant. And that's in one of the appendices. I don't remember which. Maybe 4 or 5 in the back there.

In addition, we have as I mentioned before, some of the audit reports we have reviewed licensee's CFD cases. And so that gives an example of some of the reviews and some of the issues we identified there.

DR. LU: Yes. Actually we bought 32 nodes -- cluster. NRR. And we were wrong in the CFD codes to verify licensee's safety calculation to as part of this review.

VICE CHAIRMAN BANERJEE: But is it independent in the sense you're using a different code and --

DR. LU: That's going to cost a lot. We're pretty much using -- input deck and make sure that input deck is properly setup. I think that's John has been doing.

MR. LEHNING: Yes. It's not independent, but we do make sensitivity cases that --

CHAIRMAN WALLIS: Well, can you play with turbulence modeling or something and see what difference it makes?

MR. LEHNING: Correct. That's correct. And we have done that and varied the amount of cell nodalization and things like that.

CHAIRMAN WALLIS: But the code's the same?

DR. LU: The code's the same.

VICE CHAIRMAN BANERJEE: Well, this is a more general issue which we need to take up, which is that NRC -- this is my feeling --

CHAIRMAN WALLIS: Because it's important. Because almost every plant seems to be using CFDs now.

VICE CHAIRMAN BANERJEE: Have an independent confirmatory capability.

DR. LU: Yes. That's the reason we have

been trying to push for the resources and also the manpower on this, too.

CHAIRMAN WALLIS: But we don't want to write a letter saying CFD is no good, shouldn't use it.

VICE CHAIRMAN BANERJEE: Not right now.

CHAIRMAN WALLIS: Right now. Not yet. Not yet.

Anything else here on debris transport.

Chemical effects seems to be everyone's behind. And it looks like a showstopper for some plants unless they can find a way around it.

DR. LU: As we mentioned, from low fiber plant it may not be a showstopper.

VICE CHAIRMAN BANERJEE: I mean, many people are going to encounter this problem with chemical effects, obviously. And they are proposing various innovative ways around it. Some of it is based on testing. Some of it is based on sharpening their pencils. Some taking out the buffer and some -- I guess you have to be open to all the points that you hear. There's no way out because it's all going to be sort of it's a difficult problem, obviously, everybody has a different way. But with regard to testing, how prototypical would you expect the testing to be? For example, we saw the Swiss test being done. Okay. They were adding things in a certain way. And somebody else might it in a different way and so on.

Is there some guidance or ideas that you have regarding this? Because I can see this would be a free for all otherwise as to how everybody deals with this code.

MR. KLEIN: Paul Klein from NRC Staff.

I'm not so sure it's not already a free for all. But I think we've been trying to interact with each one of the strainer vendors to understand their particular approach to chemical effects testing and then try to provide as much as possible up front or comments or questions about how they might be attempting to run their tests.

Our ultimate goal is to develop Staff evaluation guidance around the September time frame that might lay out internally what we know about chemical effects from both NRC sponsored and industry sponsored tests. And then try to highlight what we might feel is important items to be addressed in the supplements to the Generic Letter that will be provided later in the year.

CHAIRMAN WALLIS: Have you already the

Westinghouse surrogates and their use, have you?

MR. KLEIN: Well, no. Staff has not provided an SE on that particular WCAP yet.

CHAIRMAN WALLIS: So it's conceivable that you might require that the chemicals be generated in the experimental loop rather than thrown in?

MR. KLEIN: Thus far we've been trying to avoid directing strainer vendors on how to run their chemical effects tests. Because it's been such a dynamic process and we're learning as we go. We've preferred to try to let industry sort out the approaches and provide our comments as they make proposals to us.

Clearly adding the WCAP surrogate, premixing it up front so that it precipitates before the test we feel is an overall conservative technique. And it's been shown to drive head loss very high if you have a fiber bed.

Some of the questions about mixing the chemical within the loop, there are advantageous to that in that you don't have to have the concentration of chemical up front of may effect settlement, but there's also questions about how quickly it precipitates and how complete that precipitation is. And how you measure in your loop that the amount of precipitate that you intended to form actually formed during the course of the tests.

So I think we're seeing from each of these strainer vendors or different approaches and they all have strengths and weaknesses. Ultimately we think licensees will make a plant specific choice on how to get around chemical effects. Sometimes that might involve removing materials. It might involve switching buffers. It might involve potentially using a back flow type system, backflush as a defense-in-depth mechanism. So we expect at the end of the day there will be many different approaches to try and resolve that.

CHAIRMAN WALLIS: So it's a free for all, as you said?

MR. KLEIN: Yes.

VICE CHAIRMAN BANERJEE: But do you feel that -- this may or may not be resolved by the time we talk again. But certainly it won't be resolved, but you might have an adequate set of solutions. Is it an area where NRR would feel that RES should continue to do some research? What's the sense of that? I mean, there seems to be a lot of fundamental issues still being brought up --

MR. SCOTT: But if you look --

MR. WHITNEY: Great benefits and very interesting things.

MR. WHITNEY: That's right.

VICE CHAIRMAN BANERJEE: -- which could alleviate this problem, in fact?

MR. SCOTT: Mike Scott.

Remember we briefed you all yesterday on the review of the peer review comments and Staff remaining technical questions in this area. So we have a process that we're running through even as we speak for determining whether we need to push forward for additional research. So we're working on that.

CHAIRMAN WALLIS: On 41 comments or something like that.

MR. SCOTT: Right, starting from 101 down to 41, down to 17 and so on. Right. But I certainly wouldn't want to portray that I think we're going to end doing additional research on 41 items. You heard what our process is for figuring out which ones are worthy and in need of near term attention.

VICE CHAIRMAN BANERJEE: One of the things that came up in a number of these presentations was the fact that you would get some inhibition potentially from the silicone solution and things like that, which I don't know how well we understand these rates of dissolution, inhibition.

MR. SCOTT: But we're to receive a report from the industry on their efforts to take credit for that. So we will review that, although not turn out an SER.

VICE CHAIRMAN BANERJEE: Okay.

MR. SCOTT: We'll give them comments if we don't think that it is justified.

MR. KLEIN: I think with respect to silicate inhibition, that that's a particularly complex issue because with the phosphate you already have -- if you have TSP, you have a large source of phosphate present in the bottom of containment. And you pretty much understand how quickly it will dissolve.

With the silicate you have to postulate how much is formed from the break, how much transported to the pool and then how quickly it dissolves. So that becomes a more complex process.

VICE CHAIRMAN BANERJEE: Right.

DR. LU: But in addition if you look at it, the industry has been -- well, you know, conducting many, many different tests. Different vendors have their chemical, you know, effects for head loss testing. And there are lines, you know, conducting six baby loops, which each one can represent one ICET test. So I think we can gain a lot of insight based on their test and experience.

CHAIRMAN WALLIS: Well I skipped here to downstream effects, and everyone seems to be waiting for this WCAP 16406-P.

MR. SCOTT: Well, we're not waiting on it. It's in house. That one is nearing the Staff's conclusion of its review.

CHAIRMAN WALLIS: They're waiting for the--

MR. SCOTT: Oh, the licensees are waiting for us to approve it, yes.

CHAIRMAN WALLIS: Right. Waiting for you to review it. Right. So then they can use it.

MR. SCOTT: But they already have fairly high visibility on what our concerns are. Because of the various phone calls that Steve's been having with the WOG people to add this.

MR. UNIKEWICZ: This is Steve Unikewicz, NRC.

The concern -- well, as you go through

the rest of those, part of the concern is that most every licensee has not even started to use the revision. So all of and some of the comments you see on these downstream effect evaluations really pertain to their use of the earlier edition, which we had -- for all intents we rejected. We did not even take them in house for topical review.

The rest of the comments pertinent to the audits are, I'll say, outside of the scope of the WCAP. We try not to put a lot of the WCAP comments in there because for all intents and purposes they were redundant to our current RAI and our current discussions.

One of the concerns that we brought up yesterday was, yes, in fact, everybody's going to have to redo their evaluations using the Revision 1 to the WCAP.

CHAIRMAN WALLIS: Do we have some other points, or should we move to the question of what we do before the full Committee? Because my feeling, and that's before Sanjoy goes, is that the most interesting part is what industry's doing. And we've heard from the Staff many times and they're still sort of dealing with the same kind of issues. An interesting thing, perhaps, for the full Committee is --

VICE CHAIRMAN BANERJEE: The full Committee, it wouldn't be this June meeting. In July.

CHAIRMAN WALLIS: In July, yes.

MR. SCOTT: So you're in a mode here where you're going to have, I assume, a two hour session on 191?

CHAIRMAN WALLIS: It will be a two hour session, Zena, something like that?

MS. ABDULLAHI: Yes.

CHAIRMAN WALLIS: And it will be very difficult to compress four industry presentations into that period of time.

MR. SCOTT: Right.

CHAIRMAN WALLIS: Shall we pick a couple of them or should we try to do all of them? It would seem to me that Mike Scott has to make some sort of a presentation about where we are.

MR. SCOTT: Oh, of course.

CHAIRMAN WALLIS: With the ten minutes or five minutes --

VICE CHAIRMAN BANERJEE: That will go for two hours.

CHAIRMAN WALLIS: No, no, no. No

questions allowed.

MR. SCOTT: Sure.

CHAIRMAN WALLIS: Then bring the full Committee up to date on the industry activities as best it can be done.

MR. SCOTT: You mean by the Staff?

CHAIRMAN WALLIS: I don't see how -- no, by the industry.

Can NEI somehow put together a summary of things for the full Committee that is meaningful.

VICE CHAIRMAN BANERJEE: I mean, it would be necessary to have some industry people here. Don't just a summary.

CHAIRMAN WALLIS: Yes. We need to have real people here with real data I think.

MR. BUTLER: Well, I can speak at any time. My time is cheap. What you're going to have difficulty is, convincing a licensee to come back.

CHAIRMAN WALLIS: To come back.

MR. BUTLER: And for a 15 minute presentation.

CHAIRMAN WALLIS: All right. Well, we could pick the best or the worst and say you're on.

MR. SCOTT: Would you tell them which it is, best or worst, or leave them to wonder?

VICE CHAIRMAN BANERJEE: We leave that as open.

CHAIRMAN WALLIS: Well the other thing we can do is just not have anything before the full Committee. Simply have a Subcommittee report saying we heard about these things, a lot of work in process. Staff's working on it.

MEMBER ABDEL-KHALIK: But there are some,you know, basic differences in some of these approaches. For example, the water management approach is fundamentally different than many of the approaches that other licensees have followed. And we need to understand the implications of that. There might be some unintended consequences of something like, you know, deciding not to automatically actuate containment spray.

CHAIRMAN WALLIS: Well, presumably Staff is evaluating that.

MEMBER ABDEL-KHALIK: And, you know, the other sort of issue that comes across for everybody is the prototypicality of the experiments that they're conducting and how that actually represents the actual systems they're installing in the plant. It's not clear to me that one can just directly use the results of those experiments and apply them to the actual system demonstrating: (1) The geometry and the conditions that these experiments are being conducts would produce results that would allow one to evaluate what to expect in the actual system is an open issue. In my mind.

CHAIRMAN WALLIS: Well, we said that in two letters already I think. WE've raised that question.

MR. SCOTT: Well, and the Staff has also raised scaling and prototypicality, if that's the right word. We have raised that as an issue with licensees as well. And with the industry.

VICE CHAIRMAN BANERJEE: But in July, Mike, you know I wonder if we'll be at a point where we can write a letter. Because we've already written and unless it's essential, I think -- I mean, I would like to see a letter written because I can get Graham to write that.

CHAIRMAN WALLIS: Well, I would write a letter I think saying that work is going on. But that isn't much of a letter.

VICE CHAIRMAN BANERJEE: Right.

CHAIRMAN WALLIS: I usually write a letter when we have something to say which can be helpful. Either saying you're doing a lousy job, you got to improve and blah, blah, blah, blah or you're doing a great job and so on. But there's so much that's sort of ongoing we're not really in a position where we can say of those things.

MEMBER ABDEL-KHALIK: But if the issue, for example, of prototypicality of experiments has been brought up in the past several times, maybe the Staff ought to tell us what are they doing to assure that whatever experiments the licensees are doing are actually truly representative of what the expect and how we're going to go about assuring that.

MR. SCOTT: There's not a long answer to that question. The answer is is that we have put on the industry's table to address. And we don't have -- the final answers are not in yet to say whether--

CHAIRMAN WALLIS: It seems to be very ad hoc. I mean, the industry says we take this bucket and we pour it in here on top of the stuff and the conservative -- and the Staff thinks about it and says yes, that's probably conservative. There isn't some kind of scientific or standardize template or something for evaluation whether or not it's prototypical.

MR. SCOTT: Well, there will be review guidance on scaling. We're working on that now.

CHAIRMAN WALLIS: Well, are you going to have the standardized bucket method or something? What are you going to do about scaling a bucket or a guy a bucket?

MR. SCOTT: Shanlai, you want to jump on that one. I think i'll pass on it.

DR. LU: I think it's time to run away.

MR. SCOTT: You stuck around too long.

DR. LU: We are working on that as under the review guidance.

CHAIRMAN WALLIS: You are working on it?

DR. LU: Yes, we are working on the review guidance. Actually, sort of all the points--

MR. SCOTT: Standard answer, we're working on it, yes.

DR. LU: Right. And actually that's the case. And July sometime, right?

MR. SCOTT: Shanlai is anticipating going to new reactor.

CHAIRMAN WALLIS: Working on a guidance which says the bucket shall be a standard --

DR. LU: Well, no.

VICE CHAIRMAN BANERJEE: Do you want to deal with that problem in front of the full Committee?

MR. SCOTT: Not in July.

DR. LU: Not in July, I guess.

VICE CHAIRMAN BANERJEE: But when would you like to deal with that, because that is an issue?

MR. SCOTT: The review guidance, as I've said a couple of times, will be in draft form at least in September. So if we come to see you in October or sometime like that, then --

DR. LU: But I'm heading to NRO. I don't know whether I can --

VICE CHAIRMAN BANERJEE: You're going to NRO?

MR. SCOTT: He's heading to NRO after he drafts his scaling guidance.

VICE CHAIRMAN BANERJEE: He has too heavy a load.

CHAIRMAN WALLIS: So maybe the time you should come to the full Committee, perhaps to us first, is when you have this guidance.

DR. LU: That's fine. But we can't give a high level if you want.

CHAIRMAN WALLIS: We want to have an official size of the bucket and all that.

DR. LU: WE can't give a high level.

MEMBER ABDEL-KHALIK: No, other issues that came up during this past two days, presentations that would say well we can handle 90 percent blockage at the entrance to the core.

CHAIRMAN WALLIS: You're going to --

MEMBER ABDEL-KHALIK: Well, I haven't seen any details that sort of convinces me that -- that convinced me that this statement is true.

MR. SCOTT: Were there again, that --

MR. WHITNEY: Excuse me. Excuse me, sir. Walt Jensen as I remember gave a presentation where he did the calculation. Walt Jenson of the NRR Staff. And -- excuse me. And he showed at least 97 percent, maybe higher, and that the boil off would be sufficient to carry the heat.

MR. SCOTT: As Leon says, the Staff has done some --

DR. LU: Some confirmatory analyses.

MR. SCOTT: -- some confirmatory analyses. But here again, that's the topical report that the industry is due to turn into us by the end of May. We don't have it in house yet. So that we have not yet been shown the industry's answer to all these in-core --

CHAIRMAN WALLIS: There seems to be a

lot of things that you could report to us when they're finished, which is your guidance, your review of these WCAPs which are critical which you're looking at now and so on. And if those are ready in September, maybe we can have a real, really productive meeting then when we actually write a letter and say the Staff has done a great job on this, a lousy job on that and needs to do further work on this and so on and so on, whatever. You know, the usual kind of ACRS letter that you love to get.

MR. SCOTT: Oh, right. Excellent.

VICE CHAIRMAN BANERJEE: WE have a template with those words.

MR. SCOTT: Should not be issued in its current form, that kind of thing.

MR. WHITNEY: If I could just make a comment about we're receiving I think two of these this month. And it's questionable whether we would have results in September.

MR. SCOTT: Two whats?

MR. WHITNEY: Two WCAPs.

MR. SCOTT: Yes. We're actually receiving one WCAP for the purpose of writing an SE. And that's the one on in vessel. The other one I believe you're referring to is the refinements to the chemical approach, which is not going to be the subject of an SE.

CHAIRMAN WALLIS: Well, it's up to you I think to work out with Zena when it is that you have something significant which we can respond to in a significant way.

MR. SCOTT: Well, when the staff keeps the deadlines that they've been given, and I have full confidence they will make those, then we're going to have a lot of this stuff done in the September time frame.

CHAIRMAN WALLIS: It looks to me as if we should not have a meeting in July with the full Committee.

VICE CHAIRMAN BANERJEE: That's right.

CHAIRMAN WALLIS: Because the most useful thing would be to repeat some of the best of the industry presentations, and that would be too much to ask them to do.

MS. ABDULLAHI: What's the opinion of industry?

CHAIRMAN WALLIS: What do you think, John? You think it's just too much to ask these guys to come back again and make a shorter presentation to the full Committee?

MR. BUTLER: I can certainly ask, but I anticipate that the answer will not be a wholehearted "Sure, yes, we can do it."

CHAIRMAN WALLIS: I think they could do a quicker job of saying our strainer looks like this, these are the kind of tests we've run and this is our case we're going to make to the NRC. You should be able to do that in 20 minutes. And other people come, and our strainer looks like this, you know, this is -- this is the way we see -- but maybe they can't do it that quickly.

MR. SCOTT: Just as a possibility what if rather than a group of people if one person came?

CHAIRMAN WALLIS: From each one?

MR. SCOTT: Yes. Just a thought.

CHAIRMAN WALLIS: As a spokesman for each plant?

MR. SCOTT: And we know that there's an expense and a resource issue associated with this.

CHAIRMAN WALLIS: Why don't you think about that. John, it sounds reasonable?

MR. BUTLER: I will think about it. I will make the request, but I can't make any guarantees at this point.

CHAIRMAN WALLIS: Right.

VICE CHAIRMAN BANERJEE: That's all we can ask.

CHAIRMAN WALLIS: All right.

MR. SCOTT: So the way it would go is if they're willing to come in and you want to hear from me, too, and if they're not willing to come in, then I'm not worth marquee appearances.

CHAIRMAN WALLIS: WE won't have a meeting in June or July.

MR. SCOTT: Okay.

CHAIRMAN WALLIS: We'll do something else.

MR. SCOTT: Okay.

VICE CHAIRMAN BANERJEE: We'll let you do some productive work.

MR. SCOTT: Okay.

CHAIRMAN WALLIS: Work on --

VICE CHAIRMAN BANERJEE: Work on the --

MR. SCOTT: Review guidance.

CHAIRMAN WALLIS: Policy neutral frameworks and things like that.

Okay.

MR. SCOTT: So I guess then you all are expecting feedback from John Butler on the practicality of doing that, right?

CHAIRMAN WALLIS: Yes. But tell the industry that that was what we found was the most interesting power at this meeting was hearing what they're doing. And thinking about how the Staff is going to respond.

MR. SCOTT: Okay.

CHAIRMAN WALLIS: Okay. So thank you for organizing that. That was very good.

Are we ready to finish? Then in that case it being 4:00, I would declare the meeting adjourned.

(Whereupon, at 4:05 p.m. the Subcommittee meeting was adjourned.)