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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

SUBCOMMITTEE ON PLANT LICENSE RENEWAL

OYSTER CREEK GENERATING STATION

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THURSDAY,

JANUARY 18, 2007

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The meeting was convened in Room T-2B3 of Two White Flint North, 11545 Rockville Pike, Rockville, Maryland, at 8:30 a.m., DR. OTTO L. MAYNARD, Chairman, presiding.

<u>MEMBERS PRESENT</u>:

OTTO L. MAYNARD

, Chairman

GRAHAM B. WALLIS, Vice-Chairman

WILLIAM J. SHACK, ACRS Member

MARIO V. BONACA, ACRS Member

DANA A. POWERS, ACRS Member

JOHN D. SIEBER, ACRS Member

SAID ABDEL-KHALIK, ACRS Member

J. SAM ARMIJO, ACRS Member

NRC STAFF PRESENT:

LOUISE LUND
DONNIE ASHLEY
MICHAEL JUNGE
BARRY GORDON
RICH CONTE
MICHAEL MODES
JIM DAVIS
NOEL DUDLEY
P. T. KUO
SUJIT SAMMADAR

ALSO PRESENT:

MIKE GALLAGHER
PETE TAMBURRO
FRED POLASKI
AHMED OUAOU
HARDIYAL MEHTA
HOWIE RAY
TOM QUINTENZE
JOHN O'ROURKE
TIM O'HARA
JON CAVALLO
MARTY McALLISTER
JASON PETTI

ALSO PRESENT (Continued):

MIKE HESSHEIMER

PAUL GUNTER

RICHARD WEBSTER

I-N-D-E-X

I-N-D-E-X (Continued)

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

(8:33 a.m.)

OPENING REMARKS

CHAIRMAN MAYNARD: This meeting will now come to order. This is a meeting of the Plant License Renewal Subcommittee. I am Otto Maynard, Chairman of the Plant License Renewal Subcommittee for the Oyster Creek license renewal application.

ACRS members in attendance are Jack Sieber, Said Abdel-Khalik, Sam Armijo, Dana Powers, Graham Wallis, Bill Shack, and Mario Bonaca. Michael Junge of the ACRS staff is the designated federal official for this meeting. He is to my right.

The purpose is this meeting is to review the license renewal application for the Oyster Creek generating station, the draft safety evaluation report and associated documents with focus on questions that were raised during the October 3rd, 2006 License Renewal Subcommittee meeting.

We will hear presentations from representatives of the Office of Nuclear Reactor Regulation, Region I office, and AmerGen Energy Company. The subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions as appropriate for deliberation by the full Committee.

The rules for participation in today's meeting were announced as part of the notice for this meeting previously published in the Federal Register on January 25th, 2006. That's 71 FR 4177.

We have received requests for time to make oral statements from Paul Gunter of Nuclear Information Resource Service and from Richard Webster of the Rutgers Environmental Law Clinic. These statements will be considered as part of the Committee's information-gathering process. We have provided time on today's agenda for these oral statements.

Comments should be limited to the issues associated with the Oyster Creek generating station license renewal application or draft safety evaluation report with focus on questions that were raised during the October 3rd, 2006 License Renewal Subcommittee meeting.

We have received no written comments from members of the public regarding today's meeting. I will say that we did receive information from Mr. Webster in response to some questions that were at the last meeting and also copies of some of their proposed presentation material.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register notice. Therefore, we request that participants in this meeting use the microphones located throughout the meeting room when addressing the Subcommittee. Participants should first identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

It's going to be important to follow the agenda today. I am sure we will deviate some, but we do have important presentations from the license, from the NRC staff, and from members of the public. So I will be watching the time. And we all need to be paying attention to that, make sure we do focus on the right areas to get the right issues addressed in today's meeting.

I will now proceed with the meeting. And I call on Ms. Louise Lund of the Office of Nuclear Reactor Regulation to begin.

MS. LUND: Well, thank you.

STAFF INTRODUCTION

MS. LUND: And good morning. My name is Louise Lund. I am the Branch Chief of License Renewal Branch A in the Division of License Renewal. Beside me is Dr. P. T. Kuo, our Acting Director for the

Division of License Renewal.

The staff has continued their review of the Oyster Creek generating station license renewal application, which was submitted in July of 2005. Mr. Donnie Ashley, here to my right, is the project manager for this review. He will lead the staff's presentation in the afternoon.

In addition, we have several NRC members from Region I to discuss inspections that were held last October at Oyster Creek. We also have several members of the NRC technical staff in the audience to provide additional information and answer your questions.

As Dr. Maynard said at the last meeting in October last year, the ACRS Subcommittee had a number of questions. As a result of the meeting, the Committee requested additional information, specifically about the drywell shell, from the applicant, which they provided and included historical information and data as well as the results of the inspections that were held in October of 2006.

AmerGen has put together a comprehensive presentation to address the questions put forward by the Committee. In addition, the NRC staff provided a draft and final report of the analysis of a drywell shell performed at Sandia to support the staff's review. We have representatives of Sandia here to answer any questions you may about their work.

Using insights from this work, the staff issued an update to the safety evaluation in December, which we provided to the Committee. You will be hearing about this information in more detail during the meeting today. In addition, you will be hearing from the regional inspectors that were present during the inspections in October 2006 and their observations of AmerGen's inspections.

With that, I would like to turn this presentation over to Mike Gallagher, who is the Vice President of Exelon's license renewal group, to begin the applicant's presentation.

AMERGEN - OYSTER CREEK PRESENTATION

MR. GALLAGHER: Good morning. My name is Mike Gallagher. And I'm Vice President of License Renewal Projects for AmerGen and Exelon. Also with me here from our management team is Tim Rausch -- he's our Site Vice President at Oyster Creek -- and Rich Lopriore. He's our Senior Vice President for Mid-Atlantic Operations.

On October 3rd, we last met and made a summary presentation on our license renewal application, including the drywell corrosion issue, at Oyster Creek.

The feedback that we received from you was that our presentation fell short of your expectations because it did not provide a sufficient level of detail on the drywell corrosion issue.

I acknowledge the shortcoming. And we have taken action to provide you the information necessary for your review. And in response to the questions from the last meeting, for instance, you told us you wanted to see more details about the drywell shell corrosion, including source documents and data that we previously shared with the NRC staff. You also told us that you would like to see pictures of the drywell shell in the sand bed region before and after the repair.

On December 8th, we provided you with a package of information in preparation for our meeting today and in response to your request. This information package contained several white papers on key areas of drywell corrosion issue as well as the key source and reference documents.

We were also able to include inspection information from our refueling outage, which was completed since we last met. This refueling outage inspection information demonstrates that the drywell shell continues to meet code safety margins and is projected to do so through the period of extended operation.

In addition, we put together this presentation to ensure that we clearly communicate our conclusions and the detailed information upon which our conclusions are based.

There are two handouts for you today. The first is the presentation. That's the thicker handout. This is the presentation that we will be going over today. And the second is labeled "Reference Material." There are pictures. There are data graphs. And there is an integrated data sheet in there. And so we will be referring to some of that today.

CHAIRMAN MAYNARD: It will be important that we focus on the key areas. There's a lot of material, and that is very helpful. But we're not going to be able to spend a lot of time on every slide in here.

MR. GALLAGHER: That's correct, Dr. Maynard. That's why we broke it up into the reference material. If members have questions on some specific things, we can go into that. We only have some examples in the presentation. Okay?

Okay. We also included pictures of the drywell shell in the sand bed region before and after the repair. And we have also included the key data we will be discussing throughout the presentation today. We have experts here with us today to assist in our presentation and answer any questions you may have.

The purpose of this presentation is to communicate how we arrived at our overall conclusions, which are the corrective actions to mitigate drywell shell corrosion have been effective. Drywell shell corrosion has been arrested in the sand bed region and continues to be very low in the upper drywell elevations. Service life of the drywell shell extends beyond 2029 with margin. The corrosion on the embedded portion of the drywell shell is not significant due to environment of embedded steel and concrete. The drywell shell meets code safety margins. And we have an effective aging management program to ensure continued safe operation of Oyster Creek.

The way our presentation is organized today, we do have some up-front background information on the configuration and the cause and corrective actions. The first main section is the GE analysis, which we will be getting into. So if we could get through the background information, I would suggest we get through that quickly so we can get to the meat of the presentation, but we can get into any level of detail you want to get in.

CHAIRMAN MAYNARD: I understand the background. Basically we're going to focus on the water --

MR. GALLAGHER: The water leakage path.

CHAIRMAN MAYNARD: Yes.

MR. GALLAGHER: Yes. And so when we go through the configuration, we have a model here. We'll go through the water leakage path.

CHAIRMAN MAYNARD: Yes. So we don't need to go through the background of everything we have gone through before. But I do think it important to go over the water path.

MR. GALLAGHER: That's correct. So I'll turn it over now to Fred Polaski, who will lead us through that background information.

MR. POLASKI: Thank you, Mike.

As Mike said, I'm Fred Polaski. I'm Exelon's License Renewal Manager. I would like to introduce today's presenters. At the front table with me to my left is Mr. John O'Rourke. John is a member of the Oyster Creek license renewal team and formerly was the Assistant Engineering Director at Oyster Creek.

To my right is Mr. Ahmed Ouaou, who is a civil engineer on the Oyster Creek license renewal team.

To Ahmed's right is Howie Ray. He's a mechanical/structural design branch manager at Oyster Creek.

And to his right is Pete Tamburro, a member of the Oyster Creek Engineering Department, who has been involved with the drywell corrosion issue since 1988.

Other presenters today will be Dr. Hardiyal Mehta of General Electric; Mr. Barry Gordon, Structural Integrity Associates; Mr. Jon Cavallo of Corrosion Consultants and Laboratories.

Slide 3. This is our agenda for today. We're going to focus on the corrosion of the drywell shell at Oyster Creek. Mike said first we'll do a brief overview of the physical configuration and the leak path. And then we will discuss the drywell thickness analysis conditions in the sand bed region; embedded portions of the drywell shell; and, lastly, the upper shell.

If we go on to slide 5, this is a cross-section of the reactor building at Oyster Creek. In the middle is the reactor vessel shown in green with the recirculation piping and pumps. Surrounding that, the red is the drywell shell. This is shown in the refueling condition.

So the reactor head and the drywell head are removed. The reactor cavity is depicted as being filled with water in the blue cross-hatch. And surrounding the drywell is concrete shielding as part of the reactor building.

VICE-CHAIRMAN WALLIS: In this configuration is the pressure of two psi around the drywell? Is that right?

MR. POLASKI: There is no --

VICE-CHAIRMAN WALLIS: Where's the two? Isn't the refueling where you have two psi around the drywell?

MR. POLASKI: In the analysis that was performed by General Electric, they assume two pounds on the outside of the drywell.

VICE-CHAIRMAN WALLIS: I wondered where that came from and how accurate it was.

MR. POLASKI: Well, we're going to --

VICE-CHAIRMAN WALLIS: Are you going to

get into that later on?

MR. POLASKI: We'll be getting into that in --

MR. GALLAGHER: Dr. Wallis, that's an input to the analysis. It's from the standard review plan.

VICE-CHAIRMAN WALLIS: How realistic is it?

MR. GALLAGHER: It's not because the -- you know, the equipment hatches are open during an outage. So there is no --

VICE-CHAIRMAN WALLIS: Are you going to explain that later, are you?

MR. GALLAGHER: Yes. When we talk about the GE analysis, we'll have that.

VICE-CHAIRMAN WALLIS: All right.

A. DRYWELL SHELL CORROSION OVERVIEW

MR. POLASKI: So our next three slides are going to show details of the condition up here in the liner and reactor cavity, detail around a leakage path, around a bellows seal. And then we'll look at the sand bed.

Go to slide 6. All right. This is a detail of the reactor cavity liner. The cross-hatch link here is the one-eighth thick stainless steel liner for the reactor cavity that's constructed with eighth-inch thick stainless steel plates that are welded together in place during construction. And then there's concrete behind it. The plates are actually put in place first. And then the concrete is poured. And the plates are part of the form for pouring the concrete.

The blue depicts the leakage. The leakage occurs through numerous very small cracks in this liner in the weld.

VICE-CHAIRMAN WALLIS: It's detail B.

MR. POLASKI: Cause of the welds are the cracks, the stresses from welding, and fatigue on the plates. The water leaks through numerous very small cracks through the plate down between the plate and the concrete and then down into this bellows area.

Can we go to slide 7? This is the detail. Here is the refueling bellows seal. Concrete is out in this area. Below the seal is a concrete leakage collection trough, which is designed to collect any leakage from the bellows.

This is the drywell over here. And the gap between the concrete and the drywell, the red cross-hatch is a fire bar D. I will note this is not spelled correctly. It should be fire bar D and then a one-inch gap.

The leakage comes up here at two, follows the blue path down outside the stainless steel liner. At three, it comes out from under the liner into the trough. And it should all go down through this one single drain line off of this trough. There's only one drain line. It's two inches in diameter.

What happened was there was damage to this lip on this drainage trough. And so the water that was coming down here, remember, this was coming around 360 degrees around. We get into the trough and would overflow this lip into the gap down into the sand bed region.

This system, if the lip had not been damaged and the leakage was not too great would have been able to handle it. But because of the volume of the leakage in this damage, you would overflow the trough into that gap.

MEMBER SHACK: Now, did you say there's only one of those drains? So it has to flow all the way around to find the drain?

MR. POLASKI: Yes, yes. And here, remember, there's one for the trough. When we later talk about the sand bed region, there there are five. Okay? And this is one, and it's only two-inch.

There were repairs made to this in 1988. And then at that point, though, this was before we applied strippable coating to the cavity liner. The amount of leakage was such that the trough wasn't able to handle it and the drain line would still continue to overflow.

Go to slide 8, please.

MEMBER SIEBER: Well, before you move on, is the reactor cavity stainless steel liner pinned in any way to the concrete --

MR. POLASKI: I am going to ask Mr. Ouaou to answer.

MEMBER SIEBER: -- or is it free-standing?

MR. POLASKI: Ahmed?

CHAIRMAN MAYNARD: You need to use the microphone.

MR. OUAOU: Ahmed Ouaou with AmerGen. The liner has no such studs that are attached to the concrete.

MEMBER SIEBER: Okay. I presume that each time the cavity is filled and drained, there is flexure, however, of the cavity wall. Is that where the fatigue cracks are coming from or is that one source?

MR. OUAOU: That's one source.

MEMBER SIEBER: Okay. Thank you.

MR. POLASKI: Go on to the next slide. All right. This is a detail of the sand bed region. And the dimensions are shown here. The leakage, you know, we'll pick it up here at five. It comes down on the outside of the drywell shell.

This green cross-hatch is the drywell vent lines. The extent of these is about six and a half-feet in diameter. So we either come in between them or around them into the sand bed region.

And this was originally full of sand. It was emptied in 1992. There are five drain lines out of this region. These drain lines were clogged, and the water would collect in this region.

Also depicted here, inside the drywell, the red cross-hatch is the concrete floor inside the drywell at an elevation of ten feet, three inches. It has a curb on the inside at two different elevations. Eleven foot is the lower part to the curb, and 12-foot-3 is the upper part. And I will show that in our-three dimensional model.

So, with that, what I would like to do now is -- I'm going to pass this around after I talk about it. This is a three-dimensional model we have of the lower part of the drywell, 90 degrees.

The main part here, this is the concrete outside the drywell. The black here is the drywell shell. The green circles here on the inside coming out on the outside are the vent pipes that we showed you that were going to the torus.

This is the floor. Inside the drywell you will see a better one like this around. This is the curb on the inside. You can see it's lower underneath the vent headers and then higher in between.

This part of the structure here is the reactor pedestal. And inside this area is what we call the subflooring below the reactor and the control rod drives.

This small area here -- and it goes around from here and comes out on that side -- is the sand bed region. This is where it was filled with sand almost to the top. There was a small air gap. It's been removed.

This slide shows a cross-section of one of the drain lines that comes through the concrete. And the pipe just ends right here at the edge of the concrete. And I'll go into that in a little bit more detail.

On the back side here, you can see some of the other drain lines. And then these holes that are right here in between are the ten man-ways that were cut out through the concrete to gain access to the sand bed region for removal of the sand. And we use those for access to inspections during an outage.

Yes?

MEMBER SIEBER: The one purpose of the sand bed region was to provide a cushion support for the drywell base for seismic events. When you remove the sand bed, does that change the inspectoral response of the containment in the seismic event?

MR. POLASKI: The sand bed was there as a transition from a part of the drywell that's embedded in concrete to the free-standing pressure vessel.

MEMBER SIEBER: Right.

MR. POLASKI: And before it was removed, there was analysis done to determine that removing that sand would be acceptable and not having sand there was included in the analysis that General Electric did --

MEMBER SIEBER: Yes. I got the feeling from reading through that that the kinds of analysis that were done were ones that would say that when you refuel, there's downward pressure on the drywell and that it would withstand that, that it would withstand the hydrostatic pressure, but I don't recall seeing anything about seismic response.

MR. POLASKI: The analysis that was done for that condition for refueling included seismic.

MEMBER SIEBER: Okay.

MR. POLASKI: And we'll get through that in detail when Dr. Mehta gives that presentation.

VICE-CHAIRMAN WALLIS: Now, you had corrosion in the sand bed region. What did it look like? Where did this half-inch of rust go in the worst places? Was it still attached as a layer of rust or was it diffused throughout the sand bed region in some way? Was it washed away in some way or where did the steel go if it disappeared?

MR. GALLAGHER: Well, I think, Dr. Wallis, if you want to look at a picture pretty much right away --

VICE-CHAIRMAN WALLIS: Was it mostly rust in the form of attached rust or was it --

MR. GALLAGHER: Yes. We can show you a picture on page of the presentation if we can skip ahead to that --

VICE-CHAIRMAN WALLIS: It was attached rust.

MR. POLASKI: If you go to page 57 in the first --

MR. GALLAGHER: Yes, page 57 in your presentation. That's an as-found condition if we can go to 57.

VICE-CHAIRMAN WALLIS: So there was not much material in the sand that's dissolved and went into the sand or anything that was --

MR. GALLAGHER: Well, this is with the sand removed. So --

VICE-CHAIRMAN WALLIS: Yes, I know. But when you took the sand out, was it for the rust or was it just --

MR. GALLAGHER: It was sand. And this is the --

VICE-CHAIRMAN WALLIS: Sand. It was sand. Okay.

MR. GALLAGHER: This is the loose --

VICE-CHAIRMAN WALLIS: It was attached?

MR. GALLAGHER: It was attached. And then it would be removed.

MR. POLASKI: You can actually see this better on your picture, but this is the drywell shell. This area to the left is the floor in the sand bed region.

And you can see in the pictures -- it actually shows up better in the pictures you have in here -- there are heavy layers of thick rust, if you will, that were still attached. And this upper area had already fallen off.

MR. GALLAGHER: Yes. And then, Dr. Wallis, if you go to page 60 --

VICE-CHAIRMAN WALLIS: It does look like a real layer of rust?

MR. GALLAGHER: Yes.

MR. POLASKI: It was a real layer of rust.

MR. GALLAGHER: And then if you go to page 60, you see it after we cleaned it.

VICE-CHAIRMAN WALLIS: I saw some of these last night, too.

MR. GALLAGHER: Yes. Okay. So did that answer your question?

VICE-CHAIRMAN WALLIS: Yes, it did. Thank you.

MEMBER SHACK: Just to come back to your model there, those 19 grid locations that you make, those are basically measured in the notches there of the curb at the 11-3 level?

MR. POLASKI: Yes. The 19 are in this area here.

MEMBER SHACK: In those notches? Okay.

MR. POLASKI: Yes. And the reason they

had to be taken here is the elevation of the sand was 12-foot-3, which corresponds to this top of the upper curb. So that the only place that you could take the measurements was in here.

MR. GALLAGHER: And, Fred, maybe we can pass that around.

MR. POLASKI: Yes. I am going to. So now if we go back to slide -- let's go back to 9. This is a cross-section of the reactor building, the drywell up here in the upper left-hand corner and the floor in the sand bed, 20-inch man-ways that were bored in there. This is one of the five drain lines out of the sand bed region.

VICE-CHAIRMAN WALLIS: How many man-ways did you have to make?

MR. POLASKI: Ten, one into each of the ten bays. There are ten vent headers here. So you had to put one in between each because you can't get past the vent headers once you're in the sand bed.

What we have depicted here, this drain pipe comes just to the edge or extends a short distance beyond the concrete. We have installed at the plant flexible plastic catch funnels that are used underneath leaks in the plant to get a valve leaking or something to use there.

We installed on each of these drain lines five-gallon tubing run down to one of five five-gallon poly bottles, which are in the porous room that we would use to collect any water if there was still water leaking that would get into the sand bed region here.

I just want to note that here it is shown as a -- looks like an open bucket. This is really about a five-gallon bottle with a closed neck. Five-gallon tubing is in to connect it to and vent it through a filter so it's not an open bottle. So these are where any water leakage would be collected.

During the recent outage, these were checked daily. And there was no water found in any of these poly bottles. And when we were in the bays -- and we were in all ten this time -- no water was found in any of those at all during the outage.

Next slide. This is a picture of the drywell. The red at the bottom is the sand bed region. And the important thing to note here is it shows the construction of the drywell is made out of essentially square plates welded together, the lower elevation, the thickness of 1.154 inches.

As you see, as you go further up, it gets thinner in the spherical region. Then it gets very thick in the transition between the spherical and the cylinder. We call this the knuckle region there. It's two and five-eighths inches thick and then 640 mls in the cylindrical region.

Also shown here are the elevations where we take UT readings from the inside of the drywell in the upper part of the drywell. And we'll discuss those a lot more later.

MEMBER ARMIJO: How far does the fire bar D extend around that shell?

MR. POLASKI: Ahmed, can you help me with that?

CHAIRMAN MAYNARD: You need to talk into the microphone.

MR. OUAOU: Ahmed Ouaou with Exelon. Fire bar D starts at elevation where the personal air lock is, 23, and it goes all the way up.

MEMBER ARMIJO: Okay.

MR. POLASKI: Any other questions on that?

(No response.)

MR. POLASKI: Slide 11.

VICE-CHAIRMAN WALLIS: So when you took this rust off, your people went in there and chipped it away or something? How did you get it out?

MR. POLASKI: They went in and physically removed it.

VICE-CHAIRMAN WALLIS: It looks pretty claustrophobic in there, very tight.

MR. POLASKI: It's very tight. It is only 15 inches up 5 and a half feet.

VICE-CHAIRMAN WALLIS: Right.

MR. POLASKI: When we ran and graphed the work in there, there are size restrictions on people we can hire. So it's very close. They went in and cleaned it with hand tools, power-operated rotary brushes and needlepoint brushes, and removed all of the loose rust down to the only thing left there was any tightly adhered corrosion.

MEMBER ARMIJO: Did they sandblast or anything like that to get it off?

MR. POLASKI: Oh, no.

MEMBER ARMIJO: Just manual?

MR. POLASKI: Manual, yes.

VICE-CHAIRMAN WALLIS: Did you have any estimate of the amount of rust?

MR. GALLAGHER: The number of pounds of rust or something like that?

VICE-CHAIRMAN WALLIS: It was tons in my calculation. There was a lot of rust.

MR. GALLAGHER: Yes. I don't know. Pete,

do you have anything on that?

MR. TAMBURRO: This is Pete Tamburro for AmerGen. When we did go in in '92, we did do some samples of the thickness and how much had built up. And we did a correlation of how much rust products we would have expected versus the amount of loss. And it pretty well matched up.

VICE-CHAIRMAN WALLIS: So you actually weighed how much you took away?

MR. TAMBURRO: We measured the volume of how much was at a certain area.

VICE-CHAIRMAN WALLIS: Do you have a clue as to how much that was, the total rust you took away?

MR. TAMBURRO: I don't recall offhand.

VICE-CHAIRMAN WALLIS: It's useful, sort of the idea of how much there was, you know.

MR. TAMBURRO: I could get you that information.

VICE-CHAIRMAN WALLIS: If you look at the thicknesses, which are assumed in some of these calculations, it's several tons of rust.

MR. TAMBURRO: I could get you that information.

VICE-CHAIRMAN WALLIS: Okay. That would be useful. Thank you.

MR. POLASKI: Going on to slide 11, because of the corrosion, it's very simple: water accumulation in the sand bed region, resulting in corrosion in the exterior surface of the drywell shell.

Corrective actions were completed in 1992. The first one was that actions were taken to prevent water intrusion into the sand bed region. The basic way of doing this was application of metallic tape on the larger cracks on the liner and then coating of the entire reactor cavity liner prior to a slow-up in the refueling outage with a strippable coating. And this has been effective in reducing the leakage.

This last outage it was measured at about a gallon a minute. And it was well within the capacity of the leakage trough collection system and prevent any water from getting onto the drywell shell.

A second corrective action was eliminating the corrosive environments by removing the sand. And, lastly, the drywell shell after it had been cleaned of the corrosion products was coated with an epoxy coating.

MEMBER ARMIJO: Before you go on, you assert that the sand bed region -- that the water accumulated there, stayed there for a long time?

MR. POLASKI: Yes.

MEMBER ARMIJO: In the rusting --

MR. POLASKI: Yes.

MEMBER ARMIJO: Now, in the upper regions, you conclude that this fire bar D insulation retained water so that the corrosion continued because otherwise the water should have just run down the sides and nothing should have happened? So it must be porous or something that retains the water there in contact with the steel.

MR. POLASKI: Well, in the upper portion, you've got that fire bar D on there.

MEMBER ARMIJO: Yes.

MR. POLASKI: There were seven or nine flow samples removed from the drywell to determine what the corrosion mechanism was. And when they did those, the fire bar D was still attached to the plugs. And we are continuing to monitor the thickness in those areas with UT readings.

We take them at the lead areas, the thinnest areas, every other refueling outage. And as we'll get into the details later, the corrosion in that area is essentially zero except one location. I think it was .66 mls per year.

MR. GALLAGHER: But I think, to answer

your question, Dr. Armijo, the material is like an asbestos material. So it would retain water. The other thing is, you know, what you said is correct.

The other thing is that we did investigate early on whether the material within the fire bar D would have had some, say, corrosive effect. And it was concluded that it was not a contributor to the corrosion.

MEMBER ARMIJO: Other than water retention?

MR. GALLAGHER: Other than the water retention.

MEMBER ARMIJO: Okay.

VICE-CHAIRMAN WALLIS: I'm surprised there was enough oxygen. I mean, it's not water that corrodes. You need air. Don't you need oxygen there to make rust?

MR. GALLAGHER: There is an air gap.

VICE-CHAIRMAN WALLIS: Yes, but you could have the air moving to put the oxygen in there. And it's a pretty stagnant area. It's also surprising there was enough oxygen to make all that rust.

MR. GALLAGHER: Do you mean in the sand bed region?

VICE-CHAIRMAN WALLIS: Yes. And the

oxygen, you need a lot of air to make that oxygen, make tons of oxygen.

MR. POLASKI: Well, the water that would get in there during a refueling outage was oxygenated.

VICE-CHAIRMAN WALLIS: Yes, but you need a huge amount of oxygen to make the volume.

MR. POLASKI: This went on for a number of years, though.

MEMBER ARMIJO: This had gone on for a number of years before it was discovered.

VICE-CHAIRMAN WALLIS: That's still an awful lot of oxygen.

CHAIRMAN MAYNARD: Could we move on?

MR. POLASKI: Going to slide 12, we just want to get through some information on what we are doing to monitor the positions and verify that the corrective actions have been effective. During our refueling outage in October 2006, as I said before, the linkage from the reactor cavity liner is collected in a trough and out the trough drain line. It was all captured there. It was estimated about a gallon a minute. And it was captured through that drainage system and routed throughout the rad waste system and kept away from the drywell shell.

We took UT thickness measurements of the drywell at the 19 monitoring locations at elevation 11.3. This are the ones from inside the drywell down between the upper and lower curve break load event headers. And they showed no change in thickness from previous readings.

We were in all ten of the bays and did 100 percent visual inspection of the epoxy coating in each of the bays. And that was found to be in good condition. And there was no water in the sand bed region throughout the outage.

Slide 13. Outside, on the outside of the drywell surface, in the sand bed region, there were 106 UT measurements taken. These were in locations that had been last measured in 1992. Now, 1992 was when the sand was removed and the rust and corrosion was cleaned off.

At that time before they applied the epoxy coating, they determined those locations that were the thinnest regions and thinnest areas from looking at it through micrometer readings to determine the locally thinned areas. And then UT measurements were taken at those locations after having prepared the surface.

As you will see in some of the pictures, it's a very rough surface. You have to physically grind off that roughness to make it smooth enough for the UT.

VICE-CHAIRMAN WALLIS: These were taken from inside?

MR. POLASKI: No. These are taken from outside in the sand bed region.

VICE-CHAIRMAN WALLIS: And how did the person decide where to put the measuring device when --

MR. POLASKI: Okay. In 1992, there was a team of NDE technicians and engineers went in there and did it, physically an examination of the surface. They used gauges and determined the areas that had the most corrosion on them, did UT measurements. They prepped those areas. And we'll show you in some pictures that it's very obvious where those are.

And so they took the measurements. And they had dimensions of where those UT measurement locations were. So when the technicians went in this time, they were able to --

VICE-CHAIRMAN WALLIS: When the technicians made thee first measurements, someone decided where to measure.

MR. POLASKI: Yes. And that was done in 1992.

VICE-CHAIRMAN WALLIS: And if you left it in the hands of the technician, then he can choose to measure thin bits or fat bits or what depending on where he puts or she puts the device.

MR. GALLAGHER: Now, what was happening, Dr. Wallis, is the purpose of that particular inspection was to find to thinned locations.

VICE-CHAIRMAN WALLIS: Did the person deliberately --

MR. GALLAGHER: Yes.

VICE-CHAIRMAN WALLIS: -- put the device on the thinner parts or --

MR. GALLAGHER: So what was done was it was -- let me just show you an example.

VICE-CHAIRMAN WALLIS: Instructions were to put the device on the thinner parts --

MR. GALLAGHER: Yes. The instructions --

VICE-CHAIRMAN WALLIS: -- or did someone devise the grid ahead of time?

MR. GALLAGHER: Instructions were a complete visual inspection of that surface before we coated it. And the instructions were to identify locations that were thinned. And this is relative to --

VICE-CHAIRMAN WALLIS: This is why the measurements are in such strange places?

MR. GALLAGHER: That's correct. And, just to pop you to a picture, Dr. Wallis, on page 91, if we could put that up, page 91 shows an example of that. That area that's circled. It looks like a divot. That is one of the actual locations that are measured. So that divot was intentionally put in place. So, in other words, it was prepped so that you could have a --

VICE-CHAIRMAN WALLIS: Thinking you made it thinner?

MR. GALLAGHER: In that particular case, yes, you know, to get --

VICE-CHAIRMAN WALLIS: Because they were so rough that you wanted it to be smooth?

MR. GALLAGHER: Right.

CHAIRMAN MAYNARD: You wanted to get it smooth enough for the UT.

MR. GALLAGHER: For the UT. Now, because you remember on the inside of the drywell, when we take the measurements there for the 19 grids, it's smooth.

VICE-CHAIRMAN WALLIS: And you don't know how thick it is. So there's no selectivity in where you put the --

MR. GALLAGHER: So you don't have to worry about where you put the probe. Here we were identifying the thinnest locations. We identify them and then we prep them. And then that would --

VICE-CHAIRMAN WALLIS: Make them thinner?

MR. GALLAGHER: In that particular case. And in 1992 we took the measurements. We took them again in 2006. And we go into that, the sand bed presentation. We have all that data in details.

VICE-CHAIRMAN WALLIS: Okay. So all of these ringed places I see, those are places where you measured, right?

MR. GALLAGHER: That's correct.

VICE-CHAIRMAN WALLIS: All right.

CHAIRMAN MAYNARD: Now, where that transition is, is that where the sand had stopped? It looks like it's pretty dramatic there.

MR. GALLAGHER: That's correct.

MR. POLASKI: On this picture, this area down here is where the sand was and where it badly pitted, corroded, and very rust surface.

Up here, this is the thicker part of the drywell shell around the van header. So I guess one thing you can say, this line that comes down here, this is a device that they use, the NDE techs, for locating where they are taking their measurements. So this is vertical. You are looking at an angle here. So this sort of shows that at this elevation is where the top of the sand was, heavy corrosion below it, no corrosion above it.

MEMBER ARMIJO: It makes the point that if water hadn't been retained, it would have just run off and there would have been no problem.

MR. GALLAGHER: That's correct.

MEMBER ARMIJO: I take it --

MEMBER SIEBER: You mentioned that in order for a technician to find from the outside the lowest or the deepest pit, they're going to use a depth gauge of some sort?

MR. POLASKI: We did. We used micrometers.

MEMBER SIEBER: And that means that it's relative to the surrounding material. So there is a chance that you didn't get to the thinnest part because it's a relative measurement.

MR. POLASKI: Well, I think what we can say on that is because they did -- in fact, inspection was done over 100 percent of it. I mean, we're looking for relative areas. Any of the thinned areas that they found relative to the surrounding areas were identified.

And when you look at the thickness of these UT readings that were taken, they range from some of the most corroded areas to some areas that are relatively thick and not much thinner than nominal.

MR. GALLAGHER: Yes. But you are right. They are relative. And that's why in some of the bays, that there's very little corrosion. The thinnest points are pretty thick. You know, they are nominal one inch. And then, you know, in the other bays, where there was corrosion, they are thinner, but they're the thinnest points.

MEMBER SIEBER: Well, when you think about the technique, there probably isn't -- given this geometry, there isn't any other way to do it. On the other hand, there is a chance that there is a thin point that you didn't get. That chance is probably small.

MR. GALLAGHER: That's correct.

MEMBER SIEBER: But it is still there.

MEMBER ARMIJO: These readings in '92 were taken before the epoxy paint was put on?

MR. POLASKI: That's correct.

MEMBER ARMIJO: So you prepped it either grinding or water brushing or something to get down to metal?

MR. POLASKI: Yes.

MEMBER ARMIJO: And then what kind of contact? Did you use a grease or water contact for the UT probe or --

MR. POLASKI: The UT measurements are with a probe and uses a standard coupling that they use on any kind of UT ratings.

MEMBER ARMIJO: Okay. But in 2006, when you went back, it had been painted and --

MR. POLASKI: Yes.

MEMBER ARMIJO: You'll account for that in your measurement?

MR. POLASKI: Yes.

MEMBER SIEBER: You have to remove the paint to do the --

MR. POLASKI: No, you don't.

MEMBER SIEBER: -- grout right through the paint?

MR. POLASKI: The UT techniques that are available today could measure the thickness of the metal and subtract out the thickness of the coating.

MEMBER ARMIJO: Okay. We'll get to that.

MR. GALLAGHER: Yes. We have a slide on the --

MEMBER SIEBER: Yes. We'll get to that in detail later when we get to the curvature issue.

MR. POLASKI: Yes. We will get to that later.

MEMBER SIEBER: I've got a couple of questions there.

MR. POLASKI: Okay.

MR. GALLAGHER: Yes. We do in the presentation have a slide on that particular thing.

MEMBER SIEBER: All right.

MR. GALLAGHER: Okay.

MR. POLASKI: And the last point I would like to make is that UT measurements on the inside of the drywell in the upper elevations at the 13 locations that we have been monitoring since the early 1980s were performed, these we routinely do every other refueling outage and have been doing every other refueling outage. And all of these locations showed there was only one location with a very small amount of one showing corrosion.

Twelve of them showed no corrosion. And the one that did have corrosion was very low, .66 mls per year. And that location will meet its required thickness through 2029 with margin.

Slide 14 --

CHAIRMAN MAYNARD: Just a head's up here.

We're going to be tieing into a phone bridge here. And there may be some noise or whatever. So just to give everybody a head's up.

MEMBER SHACK: Just to come back, I mean, those locations are not that thinnest. So if you have ongoing rate at that location, suppose you applied that rate to another location that's thinner. Would it make your --

MR. POLASKI: Well, in the upper drywell, those are the thinnest locations. There was extensive -- and we're going to get into this detail later -- extensive investigation going on at over 1,000 locations to find the thinnest areas.

MEMBER SHACK: But the grid locations weren't necessarily the thinnest.

CHAIRMAN MAYNARD: Are you talking higher or lower?

MR. GALLAGHER: Which bridge?

MEMBER SHACK: Upper and lower. I'm sorry.

MR. GALLAGHER: In the sand bed region?

MEMBER SHACK: Yes. Okay. Right. Different regions.

(Whereupon, the foregoing matter went off the record briefly.)

CHAIRMAN MAYNARD: Go ahead.

MEMBER ABDEL-KHALIK: The first line of this table presumably refers to the 87-foot, 5-inch elevation. Is that correct?

MR. POLASKI: The cylindrical region here, yes, that's in the upper part above the sphere. Yes.

MEMBER ABDEL-KHALIK: Do you have a similar entry for the 71-foot, 6-inch elevation?

MR. POLASKI: I'll look at my drawing to make sure I'm sure it's right.

MR. GALLAGHER: Are you talking about the knuckle?

MEMBER ABDEL-KHALIK: Right above the knuckle.

MR. GALLAGHER: Okay.

MEMBER ABDEL-KHALIK: Because on your report, you indicate there was a measurement that was done at the 71-foot, 6-inch elevation, where the minimum thickness was actually .449 inches. And that would tell me that the margin available at that location would be considerably less than the margin you indicate on this table for the cylindrical region at the 87-foot, 5-inch elevation.

MR. POLASKI: So we're clear, what report are you reading from so we can --

MEMBER ABDEL-KHALIK: Your report that was submitted on December 8th.

MR. OUAOU: Ahmed Ouaou with AmerGen. I believe you had referred to the transition between the knuckle plate to the cylindrical portion.

MEMBER ABDEL-KHALIK: Correct.

MR. OUAOU: Yes. That was a measurement that was taken for the first time in 2006. And the point that you referred to is single point on that area. In fact, that would be compared against local criteria, as opposed to general criteria.

MEMBER ABDEL-KHALIK: So why is that not included in any of your tables?

MR. GALLAGHER: If we could clarify that? So what these tables are talking about is the average thickness as measured in the grids? That individual point, what you would do is compare that.

If you go to page 44, page 44 -- and we'll get into this in detail when we get into analysis. But page 44 shows the thicknesses for each location based on membrane stresses. And so, as you can see in the cylinder area, as long as it's greater than 301, it's acceptable because that's a local thickness criteria.

A single point that the thickness criteria

-- we describe this to you later in the presentation. It's basically a two and a half-inch diameter area. The thickness could be as low as 301.

MEMBER ABDEL-KHALIK: Yes. But, nevertheless, if you look at that spot, the margin would be less than the margin that you indicate for the higher elevation point, the 87 --

MR. GALLAGHER: Yes, for that specific point.

MEMBER ABDEL-KHALIK: -- foot, 5-inch elevation.

MR. GALLAGHER: Right.

MR. POLASKI: I think the major point we need to make here is that on slide 14, we're looking at average thicknesses. When we take these thickness readings and keep them for -- and a later presentation is going to go into this in great depth. It's a 6-by-6 grid, 49 individual readings that are taken.

Yes, Pete?

MR. TAMBURRO: Pete Tamburro. The inspections we did at that elevation were one 6-by-6-inch area above the transition weld on the plate that is nominally .66 inches and that one 6-by-6-inch area below the transition weld, which is a plate nominally 2 and five-eighths inch, I think.

The number that you are citing is for a plate above the transition weld.

MEMBER ABDEL-KHALIK: Correct.

MR. TAMBURRO: And that local value would be compared to the criteria for the thinner nominal plates.

VICE-CHAIRMAN WALLIS: Would you explain this difference between the required general thickness and the required local thickness? And the required local thickness would seem to depend on how big that local area is.

MR. TAMBURRO: Right.

VICE-CHAIRMAN WALLIS: Thank you.

MR. POLASKI: That's correct. And they're limited to a two-and-a-half-inch diameter area.

VICE-CHAIRMAN WALLIS: Very small area, yes.

MR. GALLAGHER: What we do -- and we'll get into this in the presentation -- is that for a grid, the average thickness is calculated. And then it's bounced off the criteria for this average thickness. Each individual point that's measured is also looked at compared to its local criteria. And all the points lead to local criteria.

VICE-CHAIRMAN WALLIS: Then you look in

adjacent points and see how big that area could be? Is that what you do?

MR. GALLAGHER: If there are multiple ones close by, that's looked at also.

VICE-CHAIRMAN WALLIS: If they're not, how big do you decide the local area is around the --

MR. GALLAGHER: The criteria for the local would be two-and-a-half-inch diameter.

VICE-CHAIRMAN WALLIS: How do you determine that two and a half is okay? Do you know that it's not bigger than that?

MR. GALLAGHER: Well, you know the grid size is a six by six.

VICE-CHAIRMAN WALLIS: If you have a fine enough grid, you can do that.

MR. GALLAGHER: -- how many points you --

VICE-CHAIRMAN WALLIS: If you don't have a fine enough grid, then you may have a difficulty.

MR. GALLAGHER: Then you would have to interrogate.

VICE-CHAIRMAN WALLIS: Yes.

MEMBER SIEBER: So you are treating this as a memory?

MR. GALLAGHER: Yes. In the upper drywell, we get into that. The upper drywell is controlled by membrane stresses. Buckling only controls in the sand bed.

MEMBER SIEBER: So that applies to hydrostatic forces.

PARTICIPANT: Pressure.

MR. GALLAGHER: The stresses, the membrane stresses.

MEMBER SIEBER: Right.

MEMBER ABDEL-KHALIK: So when that measurement at that location was made, it indicated a local fitting down to .449 inches at that location. It was decided not to enlarge the area of measurement. Why was that decision made?

MR. TAMBURRO: Again this is Pete Tamburro. We did review the data points around that. And that was a localized area. The other data points around it were thicker. We did investigate the data around that one individual point.

MEMBER ABDEL-KHALIK: Within the six-inch by six-inch area, but you didn't look at another six-inch by six-inch area in the immediate neighborhood?

MR. TAMBURRO: No.

MR. POLASKI: Any other questions?

(No response.)

MR. POLASKI: Okay. That concludes my portion of the presentation on the overview and the physical condition of the plant. We're now going to go onto the section on the drywell shell thickness analysis. And I would like to introduce Dr. Hardayal Mehta of General Electric.

Dr. Mehta received his Ph.D. from the University of California at Berkeley. He's a registered professional engineer in the State of California and was elected an ASME fellow in 1999. He is the author or co-author of over 35 ASME papers.

Dr. Mehta has been with GE Nuclear Division since 1978 and currently holds the position of chief engineer, mechanics. He has over 30 years of experience in the areas of stress analysis, linear-elastic, and elastic plastic fracture mechanics, residual stress evaluation, and ASME code-related analyses for things with BWR components.

He has also participated as principal investigator or project manager for several BWR, VIP BWR owners' group, and EPRI-sponsored programs at General Electric.

Prior to joining General Electric, he was with Intel Corporation, where he directed various piping and structural analyses.

Dr. Mehta?

DR. MEHTA: Thank you, Fred.

B. DRYWELL SHELL THICKNESS ANALYSIS

DR. MEHTA: Good morning. I'm going to describe some of the structural analysis details of the drywell that we did contract. Going to slide 16, the analysis was completed in the early 1990s. And definitely this one, the analysis was without sand in the sand bed region.

I am going to provide some details on the modeling of the drywell, which was finite element model details; and the loads, load combinations that we used; and followed by the buckling analysis details, in which the sand bed region is controlled by the thickness. And the analysis that we did, buckling analysis, the sand bed thickness was assumed as uniform value of 736 mls. You recall the original thickness was 1.154 inches.

Again, in the ASME code analysis, which is the section 8 analysis, we used 62 psi as the peak pressure. And later on in the presentation, Mr. Ahmed Ouaou will be presenting results where the 62 psi peak pressure was reduced to 44 psi based on the peak pressure calculations that were done separately.

Go on to the next slide. This now is the modelling of the drywell in detail, slide 18. This, the first bullet provides some of the details of the general bulk of details in terms of height, diameter, and so on.

At the bottom of this slide, I have the material. The material that was ordered for the drywell, which is the material for the sphere, slender, dome, and transitions was SA-212, grade B material, which was over to S-8 standard specification.

Currently that material would be equal into SA-516, grade 70, which has 38 ksi yield and 70 ksi ultimate stress, essentially equal into what we will order the material today.

MEMBER ARMIJO: Were those properties, mechanical properties, verified by independent testing or was that just as specified?

DR. MEHTA: As the ASME 8 to the quadrants, which are essentially equal into section 3 and also the environments, which were also verified.

We go on to slide 19, finite element involving details. We used clean models, axisymmetric, B model, and the pie slice model. The axisymmetric model we'll use for the unflooded and flooded seismic inertial loading and also for the thermal loading during the postulated accident condition.

The B model we used to come up with the initial spectrum analysis and to also check the John Blum original analysis. So that was used. And also we developed the displacement for the displacement or anchor displacement model.

The pie slice model was used for the section 8 analysis and buckling analysis that had all of the details essentially, like, for example, vent lines, which in axisymmetric model is not possible to present.

And, again, to emphasize, there was no sand thickness used in the studies, essentially assuming the sand had been taken out.

MEMBER SIEBER: So from the bottom of the sand bed on up, it's all free-standing?

DR. MEHTA: Yes.

MEMBER SIEBER: Okay. Thank you.

DR. MEHTA: Next slide. In the pie slice model, which is essentially where we transferred the load from the axisymmetric model, like seismic inertia and displacement were applied to the pie slide model.

In this case, given that there are ten vent lines, we used one-tenth, which is one-tenth of

360-degree would be 36-degree pie slice. And essentially at that time the capabilities, comparable capabilities, that we're developing, that was consistent with that.

And the ANSIS model included from the drywell shell from the base of the sand bed all the way up to the top. And also the drywell thickness that was used was assumed in this analysis at 736 mls uniform throughout the sand bed region.

The next slide shows a picture of this. And what you will see, different colors here are essentially the thickness differences. That is, each color represents a particular thickness. And the sand bed region, which is at the bottom, has 736 loads thickness.

Move on to the next slide. In terms of the applied loads that we considered in the analysis, the gravity loads consisted of deadweight loads, penetration loads, live loads, and also during the refueling condition, the water load that is applied.

MEMBER ARMIJO: Does that include all the water that's inside the torus hanging off the vents?

DR. MEHTA: I believe that is the water that backs through the drywell dock head. And that --

MR. POLASKI: No.

MEMBER ARMIJO: No.

MR. POLASKI: I think that Dr. Armijo's question was, does this analysis include the weight of the water down in the torus at the end of the vent line?

MEMBER SIEBER: The torus is reported separately from the drywell.

MEMBER ARMIJO: It is reported separately. So it's not transferring weight.

MEMBER SIEBER: There is some flexure in this.

VICE-CHAIRMAN WALLIS: There is some sort, yes. There is some sort of a bellows or something.

DR. MEHTA: That is how essentially we only -- the torus is actually isolated.

MEMBER SIEBER: It's independent.

DR. MEHTA: And the only modeling in terms of this thing we had was the vent line and then the vent header to which it connects. So that's where we have to --

MEMBER ABDEL-KHALIK: So there is no load transmission along the vent lines?

MEMBER SIEBER: Well, it's pressurable.

DR. MEHTA: It's only from just the edge, whatever passes through the vent header and so on, just connection, being connection. But basically that didn't affect much of the analysis.

MEMBER ARMIJO: Okay.

DR. MEHTA: The accident pressure at that time was 62 psi peak pressure. That was used in the analysis. And you will also see later on that through tech spec amendment, there was change of the peak pressure to 44 psi.

And the test results are in the data slides. At the end of this presentation, Mr. Ahmed Ouaou will be presenting the results corresponding to what we forecast.

There were accident condition temperature stresses, which are thermal gradient stresses are there. Those would be included as a part of the accident condition analysis.

MEMBER ABDEL-KHALIK: Now, the mechanical properties that you quoted earlier, the 38 ksi yield stress and the 70 ksi ultimate strength, are those at 175 degrees F.?

DR. MEHTA: Those are up to about, I believe, 200 degrees Fahrenheit. So that's essentially consistent with the temperature with the stress of the next model.

And it's the same way in the case where

the maximum stress is primary. Plus, secondary stresses that we see are actually during the post-accident condition. But the accident condition where the primary stress is maximized, the temperature is within the range of those properties.

The seismic loading we considered was inertial loading, which is due to the spectrum loading, and also the relative anchor displacement. Essentially in this case the drywell is connected to star truss. And that provides a later restraint. And that was used in the analysis.

And also during seismic shaking, there will be something that the reactor building will take the drywell for a ride, certain displacement that occurs. And that's 58 mls.

And that also produces seismic stresses in the drywell, which was considered in this analysis. In fact, that was about two-thirds of the --

VICE-CHAIRMAN WALLIS: Now, in a seismic event, does water slosh around inside this?

MEMBER SIEBER: Torus.

VICE-CHAIRMAN WALLIS: Well, also isn't there water in the drywell, too, or there isn't a combination of accident and seismic? So --

MR. GALLAGHER: In the reactor cavity are you talking about, Dr. Wallis?

VICE-CHAIRMAN WALLIS: Yes.

MR. GALLAGHER: For the refueling case, there would be water in the --

VICE-CHAIRMAN WALLIS: You don't have seismic and refueling at that same time. So you don't have water in there during the seismic event?

MR. GALLAGHER: Yes. The load combination is seismic event, refueling with the two pounds external.

VICE-CHAIRMAN WALLIS: So does the water slosh around up there and --

MR. GALLAGHER: I guess. I mean --

VICE-CHAIRMAN WALLIS: Does that get analyzed?

DR. MEHTA: It was indicated that the only effect would be the weight of the water, which would be, in fact, if you take into account the other structures about 80 percent would be effective. So if we took the 80 percent of the water during the --

VICE-CHAIRMAN WALLIS: But does it move around dynamically, this water in a seismic event? And do you get extra loads because the water is sloshing around?

DR. MEHTA: Based on our previous

experience, it was our engineering judgment that because on what we would see, the sloshing would be minimal and would not, in fact, be --

VICE-CHAIRMAN WALLIS: It's so small, yes, because --

CHAIRMAN MAYNARD: That area would be fairly full of water, correct? Any sloshing at all would be spilling over the side, rather than sloshing.

VICE-CHAIRMAN WALLIS: Yes. As long as it's full, as long as it's full, you might be okay.

MR. GALLAGHER: And the displacements, Dr. Mehta, what's the displacement we're talking about?

VICE-CHAIRMAN WALLIS: It's very small.

DR. MEHTA: For example, anchor displacement was 0.058 inch. So we are looking at a very small displacement. And so it was our judgment that the sloshing wouldn't be significant.

Going to the next slide.

VICE-CHAIRMAN WALLIS: Are you going to explain to me now where the two psi comes from? Sorry.

MEMBER SIEBER: Let me just ask a quick question that will clarify something for me. On slide 23, you talk about the upper constraint. And if you go back to slide 5, which is the drawing, could you show me where the upper constraint is? Detail B. Is that it?

PARTICIPANT: You'll need to talk into the microphone.

CHAIRMAN MAYNARD: Yes. You'll need to talk into the microphone.

MR. POLASKI: Again, you have to talk into the microphone.

(Laughter.)

PARTICIPANT: It's a test.

MR. GALLAGHER: Ahmed, why don't you point to it? And, Dr. Mehta, you can --

CHAIRMAN MAYNARD: Microphone. You need to be talking into the microphone, please.

VICE-CHAIRMAN WALLIS: They're consulting.

DR. MEHTA: I believe it is at 74 feet, 3-inch or something.

CHAIRMAN MAYNARD: Again, microphone. Somebody needs to be talking into the microphone while somebody else is pointing.

MEMBER SIEBER: That's elevation 82 where you're pointing.

MR. OUAOU: The elevation, as indicated on the slide, is at 82, Dr. Mehta.

MEMBER SIEBER: Yes. Now, what does that

consist of? Right now it looks like there's no contact. So why is that an upper constraint?

MR. OUAOU: What it is -- Ahmed Ouaou with AmerGen. What it is is a lug welded to the back of the shell with an insert in the concrete.

MEMBER SIEBER: Okay.

MR. OUAOU: And that is a gap, a fairly small gap, to allow for some movement, yet not restrained in the containment.

MEMBER SIEBER: And then surrounding that during construction was this insulating material?

MR. OUAOU: That's correct.

MEMBER SIEBER: Okay. Thank you. Appreciate it.

CHAIRMAN MAYNARD: I believe Dr. Wallis had a --

VICE-CHAIRMAN WALLIS: While we're on the -- he's going to get to the next slide.

MR. GALLAGHER: Yes, slide 24.

VICE-CHAIRMAN WALLIS: So when he puts up 24, we'll ask him that one.

DR. MEHTA: Slide 23. In the seismic load definition, we use axisymmetric model. And, as the earlier discussion indicated, we considered the restraint at the star truss, which is 82 feet, 6 inches.

And we had two spectra, one at the foundation and the other one at the upper constraint. We used the envelope of the two spectra to input into the analysis, which was the axisymmetric model. From that, we look at the expiration profile, which was then put into the pie slice model.

The next slide shows the load combinations and the constituent loads.

VICE-CHAIRMAN WALLIS: Where did this two psi come from? Where did this two psi come from, this two psi external? Is that a realistic number or is that just some sort of conservative assumption or what is it? Where did this two psi come from? And is it realistic?

DR. MEHTA: This was in the specification.

VICE-CHAIRMAN WALLIS: Is it realistic? Does it happen? I mean --

MR. GALLAGHER: No, it does not.

VICE-CHAIRMAN WALLIS: Why do you put it in there?

MR. GALLAGHER: It's a conservatism. I think Dr. Mehta explained why that would be conservative.

MR. POLASKI: Ahmed, do you want to do it?

MR. OUAOU: Ahmed Ouaou with AmerGen. That two psi was part of the original design basis of the containment. It was in UFSAR. And it was felt that we should maintain the original load combinations that were in the UFSAR.

MR. POLASKI: This would imply that there is some cause for this pressure difference and that it's maintained in some way.

MR. OUAOU: Well, during normal operation of the plant, you would have that external pressure of two psi, but if --

VICE-CHAIRMAN WALLIS: Because there's a vacuum maintained inside?

MR. OUAOU: That's correct. But if the hatches are open and so on, you shouldn't really expect to see that, but for conservatism, to be consistent with the CLB of --

VICE-CHAIRMAN WALLIS: So you see the normal operation, but you wouldn't see it in refueling? Is that what it is?

MR. GALLAGHER: Dr. Wallis, just a clarification. For normal operation, I mean, normally you maintain the containments slightly pressurized.

VICE-CHAIRMAN WALLIS: You have two psi, then?

MR. GALLAGHER: No. Slightly pressurized, one pound. So you would have one pound in containment normally. And this is a two-pound external.

VICE-CHAIRMAN WALLIS: It's being conservative.

MR. GALLAGHER: Right.

VICE-CHAIRMAN WALLIS: During refueling, do you have that same thing?

MR. GALLAGHER: No. The refueling hatches are open.

VICE-CHAIRMAN WALLIS: Right. And how much of a contribution is this two psi to the buckling? It is trying to collapse things, isn't it?

DR. MEHTA: Two psi produces about 600 or 700 psi compressive pressure --

VICE-CHAIRMAN WALLIS: That's significant.

DR. MEHTA: -- stress in the sand bed region.

VICE-CHAIRMAN WALLIS: Right. So you're adding something which is not realistic?

DR. MEHTA: That is conservative.

VICE-CHAIRMAN WALLIS: And how much of a contribution is this to the proportion of the stress? It's a big contributor, isn't it?

MR. GALLAGHER: No.

VICE-CHAIRMAN WALLIS: You said 60,000 psi produces --

PARTICIPANT: Six hundred.

MR. GALLAGHER: Six hundred.

DR. MEHTA: Six hundred. Yes.

VICE-CHAIRMAN WALLIS: Oh, that's all?

MR. POLASKI: So I guess the question would be, do you know? Did you do any studies? If you did not include the two psi internal pressure, how much difference would that have made in the results?

DR. MEHTA: It would be the compressive loading, which produces buckling in the sand bed region, would be lower by 600 psi.

VICE-CHAIRMAN WALLIS: Only 600 psi. That's not a lot, no.

MEMBER SIEBER: That's not a lot.

VICE-CHAIRMAN WALLIS: Okay. Good.

DR. MEHTA: Overload, as I would explain in the buckling case, is about 7.5 psi compressive stress.

MEMBER ARMIJO: So you could look at that two psi as really margined in your analysis that you haven't taken credit for?

MR. POLASKI: Yes, you could.

MEMBER ARMIJO: I mean, it's small, but

it's not working in the wrong direction?

MR. GALLAGHER: Right. That's correct.

DR. MEHTA: In the load combinations, again, the refueling condition was gravity loads; pressure; water load; and the seismic, which was actually two times the design basis earthquake, which is the SSE condition. In effect, that is also conservative in the sense that generally for refueling and accident condition, it's the OBE, or operating basis earthquake, is considered into the evaluation.

MEMBER ABDEL-KHALIK: So which mechanical properties did you use for the 281 degrees F. analysis?

DR. MEHTA: In that one, the temperature gradient stress corresponding to that would be for the SA-212, grade B we used corresponding to between 200 and 300 Fahrenheit "properties." From that, we used the average value.

MEMBER ABDEL-KHALIK: And what were those values compared to the room temperature values that you quoted earlier?

DR. MEHTA: It's up to 200 I believe are the same, no change.

MEMBER ABDEL-KHALIK: Okay.

DR. MEHTA: There is a slight change from

200 to 300 degrees Fahrenheit, but in this case, the 200, 175 degrees essentially --

MEMBER ABDEL-KHALIK: I'm asking about the 281 degrees F. analysis.

DR. MEHTA: Yes. In that one, at that point, we linearally interpolated the properties, like E and alpha.

MR. GALLAGHER: Right. Do you recall the number, Dr. Mehta? I think he's asking for a number. Do you recall the number or do we have to get back to him?

DR. MEHTA: Number? I'm sorry. I don't have it, but for cog and steel, E would be like about 26 or 27 10^{6} psi. And then the alpha would be about 6. or 7.0 times 10^{-6} inch per inch.

MR. GALLAGHER: Thank you.

CHAIRMAN MAYNARD: Said, is that something you would like for them to get back to you on or --

MEMBER ABDEL-KHALIK: I think it would be a good idea to know the properties that were used in these calculations just for the record.

MEMBER ARMIJO: But the point is you did take into account the different mechanical properties at the higher temperatures and you have that data available for us?

DR. MEHTA: Yes.

MEMBER ARMIJO: Okay. Thank you.

VICE-CHAIRMAN WALLIS: Now, this 74-foot, 6 inches, is this vessel always filled so much during a post-accident condition? This is almost filling the whole thing, isn't it? This is an extreme case of some sort or what you expect in a post-accident condition?

MR. GALLAGHER: Yes. I think this goes all the way up to the vent.

VICE-CHAIRMAN WALLIS: Yes. It goes all the way up to almost fill the whole thing.

MR. POLASKI: These are the load cases that we have to analyze.

VICE-CHAIRMAN WALLIS: This is some conservative extreme assumption, is it, or something? This is the most water you could possibly put in there before it comes out?

PARTICIPANT: That's correct.

MR. GALLAGHER: Yes, this is conservative.

VICE-CHAIRMAN WALLIS: It just seems unusual. Maybe I don't understand the post-accident scenario.

MR. GALLAGHER: I mean, these are the load combinations that we're required to analyze for.

MR. POLASKI: These are the load combinations. These are the ones that in the current licensing basis before this analysis --

VICE-CHAIRMAN WALLIS: This in the worst that could possibly happen that you fill the whole thing up to the vent.

MEMBER SIEBER: It's very conservative.

MR. GALLAGHER: And, Dr. Wallis, I mean, you're hitting on some good points because if you even think this whole refueling, the refueling is our limiting case here for buckling. And so you think about it.

What it is is during refueling, which only occurs about 20 days out of every 2 years, that we would have a seismic event twice the design basis and we have this external pressure on the containment.

So probablistically it's pretty small, but this is what we're required to analysis for.

CHAIRMAN MAYNARD: Yes. The requirements for these types of analysis do require that level of conservatism.

MR. GALLAGHER: That's correct. That's correct.

CHAIRMAN MAYNARD: Yes.

DR. MEHTA: And these were also provided

in the design specification, which was the basis for the analysis that --

MEMBER SIEBER: Right. Okay.

VICE-CHAIRMAN WALLIS: But if we're trying to look at what is the real risk of something, it is nice to know what is the reality as well as what is some design specification.

MR. GALLAGHER: Right. I understand.

VICE-CHAIRMAN WALLIS: Could someone explain to me maybe later on about when, in ever, you get this 74-foot, 6 inches occurring in reality?

MR. POLASKI: We probably don't have that --

MR. GALLAGHER: We will follow up. We can follow up in a brief because what you would be into is your trip, your emergency operating procedures.

VICE-CHAIRMAN WALLIS: Right.

MR. GALLAGHER: And so it would be way beyond anything normal.

VICE-CHAIRMAN WALLIS: Okay.

MR. GALLAGHER: Yes.

DR. MEHTA: These load combinations that were used, now moving on to buckling analysis, 26, what I have provided here is first the basic summary of the buckling analysis. This was conducted in the uniform drywell shell thickness of some 36 mls in the sand bed region.

The stress limits and safety factors in accordance with the code requirements, the analysis showed that the code case and 284 requirements are met and considered the design basis load and load combinations which were consistent with that as a part of the sensitivity study, would that consider a local area which is beyond the 736 ml thickness with a local thickness reduction of 536 mls, which is when we found that there was a more significant impact on the buckling.

And the last one is, as you would see, some more details of how the 736 mls are being monitored against acceptance criteria, which --

VICE-CHAIRMAN WALLIS: All right. When you do the buckling analysis, do you actually model the instability and its growth? Do you actually let the thing proceed to buckle or is it some kind of empirical method? Do you actually let the thing crumple when you do your analysis? It begins to go unstable and then presumably you stop or do you use some ASME coefficients of some sort?

DR. MEHTA: We use first the ANSIS model, which gives us the theoretical buckling load. And then we actually reduce that by the so-called capacity reduction --

VICE-CHAIRMAN WALLIS: But you have to assume some sort of Eigen function or something. You have to -- I'm trying to figure out how much of this -- does ASME build some conservativeness or do you actually analyze the thing to the point where it collapses?

DR. MEHTA: The collapsed load was calculated, but then we apply -- the code case in 284 has reduction in the theoretical calculated buckling load corresponding to what the --

VICE-CHAIRMAN WALLIS: How do you calculate the buckling load, then?

MR. GALLAGHER: I think if I can just interject here because I think Dr. Wallis is after looking at what margins are available --

VICE-CHAIRMAN WALLIS: No. Actually, does it buckle?

MR. GALLAGHER: No.

VICE-CHAIRMAN WALLIS: Your analysis doesn't go to a large deflection.

MR. GALLAGHER: You go to a stress value, but there's a safety factor in there. And the safety factor is dependent on your load combination either 2 or 1.67. And Dr. Mehta will go through that, but so you go to the stresses with safety factor.

VICE-CHAIRMAN WALLIS: The buckling criteria -- and there is some ASME mixture of factors, rather than actually calculating buckling happening. Is that right?

MR. GALLAGHER: Yes.

DR. MEHTA: You're looking at buckling load, which I think the next couple of slides illustrate the process that you follow.

MEMBER ARMIJO: Basically you only get to a stress level that's half of what's required to buckle. You don't actually --

MR. GALLAGHER: Right, because there's a safety factor, too.

MEMBER ARMIJO: Yes.

MR. GALLAGHER: So you would get down to there still should be --

VICE-CHAIRMAN WALLIS: But you still have these NIs and alpha I's and those things.

MR. GALLAGHER: Yes.

CHAIRMAN MAYNARD: I appreciate everyone's patience here. We do have a number of people listening on phone calls. And it's important that we speak into the microphone and speak with a loud voice so that everybody can hear.

DR. MEHTA: In the next slide, I will have some of the details of the --

MEMBER ABDEL-KHALIK: Can we go back to slide number 26? The locally thinned area, the 12-inch by 12-inch area, where was that located in the 36-degree pie slice?

DR. MEHTA: That was in between the -- for the sand bed because we believe that's where we saw buckling mode shape --

MEMBER ABDEL-KHALIK: No. Azimuthally where is it located? Around the angle within the 36-degree pie slice?

DR. MEHTA: The 36-degree --

MR. GALLAGHER: It would be at the two edges.

MEMBER ABDEL-KHALIK: At the two edges. So half of it is located on one edge, and the other half is located on the other edge of the --

PARTICIPANT: So when you put the slice together, it's a 12-by-12.

MEMBER ABDEL-KHALIK: In the middle, between the two vent --

PARTICIPANT: And that's where the most stresses are --

MEMBER ABDEL-KHALIK: Thank you.

MEMBER ARMIJO: I have a question on that I meant to ask earlier. You say the 12-by-12-inch area, 536 would have no significant impact on buckling. For that same thinning, how big an area would have a significant effect?

In other words, if this were a 4-foot by 4-foot area at 536, would that make a difference? Would it be -- you know, I would like to just know how conservative or non-conservative is it, this 12-by-12-inch.

DR. MEHTA: In this 12-inch by 12-inch area, where we put that in the worst location, we found about approximately a 9 percent reduction in the buckling load, which is kind of like considered like plus/minus 10 percent in the ASME code in the --

MEMBER ARMIJO: If you have made that area twice as big, would it have been like an 18 percent reduction in the buckling load or is it linear? I'm just trying to get an idea of how much of a --

DR. MEHTA: We only went up to 12-inch by 12-inch, but my guess is that there will be further reduction. If it were a much larger area, then there would be a somewhat larger reduction. But in this case, we only considered 536.

MR. POLASKI: So, Dr. Armijo, I think the answer to your question is that they only looked at a 12-by-12. And, actually, that 12-by-12 then tapers from 536 to 736. We did not investigate if there were larger areas.

And I don't believe that there was a need to do that based on the information they had available at the time. And we confirmed that later with NT measurements if there's no areas that come even close to this 536 on one-foot-square area.

MEMBER ARMIJO: Right. Basically if you conclude that where you have data it represents a 12 by 12-inch region and the worst, if you measure a thin area -- I guess I lost my train of thought. I'm just trying to find out what we have to worry about here and --

MR. POLASKI: Later in the presentation -- I would like to hold it until we get to it -- we've got a diagram that shows all of the readings that were taken on the containment. I think that will give you a good picture to show you that no areas are anywhere close to 536 in this kind of --

MEMBER ARMIJO: Of that much area?

MR. POLASKI: Yes, that much area, nothing anywhere --

VICE-CHAIRMAN WALLIS: I would like to ask that this -- this is a GE analysis. Sandia also did an analysis. Are we going to hear a presentation of the Sandia? We are? Okay. Thank you.

MS. LUND: Yes. That will be later on this afternoon.

VICE-CHAIRMAN WALLIS: Okay.

DR. MEHTA: In the next slide, this slide illustrates the equation that was used for the log or compressive stress or buckling stress. As you will see, the first one on the numerator of this equation, on the right-hand side is sigma IE.

That is the theoretical stress, which when we do the modeling and just let it run, it will give an item value which is how much is the -- what is the theoretical buckling load for perfect shell as it is modeled is the buckling load compared to the applied load. If the item value is six, that means the theoretical buckling load is six times the upper --

VICE-CHAIRMAN WALLIS: Buckling is a global phenomenon, isn't it? It's not a local phenomenon?

DR. MEHTA: Right.

VICE-CHAIRMAN WALLIS: So how can there be a stress?

DR. MEHTA: In the ANSIS model, it starts off with whatever is the lowest particular -- wherever the buckling is happening first. And so we look for the lowest item value. And that is the lowest buckling load. And then there are higher item values, which will show that some other locations may be valued.

So in this case, we use the boundary conditions in this one, symmetric-symmetric and so on, just to make sure whichever gives us the lowest ideal value.

VICE-CHAIRMAN WALLIS: I understand that, but where is this stress? I mean, if you have a narrow region, the stress is bigger there. So presumably the thinner region, the stress is bigger. So where is this allowable compressive stress? Is it the maximum one somewhere?

MR. GALLAGHER: We have a couple of --

MR. POLASKI: We have some pictures that we will show you --

MR. GALLAGHER: Slide 31 and 32 I think will hit that point.

VICE-CHAIRMAN WALLIS: But if you have a stress distribution, buckling must be something to do with the entire distribution, not just the local stress.

MR. GALLAGHER: Dr. Wallis, if we could go to slide 31?

VICE-CHAIRMAN WALLIS: Maybe it's too complicated to explain.

PARTICIPANT: No, it isn't.

MR. POLASKI: Let's let Hardiyal go through. And we'll get to that. I think we'll show you the answer in a couple of slides.

VICE-CHAIRMAN WALLIS: Maybe Dr. Shack understands it all and can explain it to me in the break.

DR. MEHTA: So the sigma IE in this equation is the theoretical buckling stress. And then on the left of that is alpha I, which is the reduction of the reduction --

VICE-CHAIRMAN WALLIS: Is this an average stress or something? Where do I get this sigma IE?

DR. MEHTA: It's the average in the sense that the average in a stress in the sand bed region. And if I use that as a number --

VICE-CHAIRMAN WALLIS: Average stress?

DR. MEHTA: For the purposes of multiplying to get a theoretical number. Otherwise the stress distribution, we realize that it varies through the sand bed region. But in order to apply the item factor of like 6.141, whatever the stress is, whatever the stress in the sand bed region, it is 6.141 times or the --

VICE-CHAIRMAN WALLIS: Average stress? Times the average stress?

DR. MEHTA: It is for the purposes, Dr. Wallis, if we have to use a number, we use the average stress, but that --

VICE-CHAIRMAN WALLIS: Sigma IE is an average stress?

DR. MEHTA: Average stress.

VICE-CHAIRMAN WALLIS: Thank you. That's what I was trying to figure out.

MR. POLASKI: Dr. Mehta, just to be clear, it's the average in that grid, right, because you're on a --

DR. MEHTA: Or it's to the section through the sand bed region.

VICE-CHAIRMAN WALLIS: It's the whole thing. Yes. That's what I'm trying to get. Okay. And so a slightly thinner, narrower region wouldn't affect that significantly, right?

DR. MEHTA: Right. We essentially --

VICE-CHAIRMAN WALLIS: All right. That's

what I'm trying to get at. Thank you.

DR. MEHTA: In the one key factor in the analysis --

VICE-CHAIRMAN WALLIS: I'm sorry. This compressive stress, does it matter which direction this stress is on? You have tangential, and you have whatever you call the other ones, longitudinal or something stresses. Which stress is it or is it some combination of these stresses?

MR. POLASKI: So the question is, what combination of stress --

VICE-CHAIRMAN WALLIS: Yes. Stress is a tensor, isn't it? Which stress are you looking at here?

DR. MEHTA: There were all the applied stresses to the model as they -- you know, like, for example, the seismic stresses in the --

VICE-CHAIRMAN WALLIS: Yes, but stress is a tensor. So which stress is this stress?

DR. MEHTA: They were compressive in the --

VICE-CHAIRMAN WALLIS: In which direction? In the longitudinal? In the vertical sort of direction or the tangential? Does it matter which one?

DR. MEHTA: In the vertical direction, which is the meridional direction, they were compressive.

VICE-CHAIRMAN WALLIS: That's the one you look at, the meridional. So the tangential stress, which we get in another mode somewhere here, doesn't have any effect? The circumferential compression doesn't tend to buckle it, like squeezing it a beer can and buckling it? It doesn't --

DR. MEHTA: The geometry of this is such that that meridional with compressive stress along with this thing produces tensile or hoop stress, which is a circumferential direction, which it tends to straighten out any imperfections, which may contribute to buckling. So we did take that into account, effect in order to modify the capacity reduction factor.

MR. POLASKI: Dr. Wallis, I think the next couple of slides will show you diagrammatically that the different --

VICE-CHAIRMAN WALLIS: So this compressive stress that's here, the sigma IE, is the meridional stress? Yes, this one. It's this one. It's not the circumference.

MR. POLASKI: It's this one, yes.

VICE-CHAIRMAN WALLIS: And the

circumferential one has no effect?

MEMBER ARMIJO: It looks like it must because that's --

VICE-CHAIRMAN WALLIS: Must.

CHAIRMAN MAYNARD: Why don't we move on to a couple of slides? And then if it's not clear after that --

VICE-CHAIRMAN WALLIS: Maybe it will never become clear.

MR. POLASKI: Let's go through the slides.

DR. MEHTA: The slides will show buckling shape and the --

VICE-CHAIRMAN WALLIS: That helps. That helps, yes. That helps.

DR. MEHTA: And the third factor will be the eta I in this equation, which is the plasticity. If it turns out that the buckling, calculated theoretical buckling stress, is quite a bit higher than the proportional limit, then there will be some plasticity. And there should be --

VICE-CHAIRMAN WALLIS: Right.

DR. MEHTA: Correspondingly, the load should be reduced. So we use that also as the factor eta I. And so overall the allowable stress is calculated firstly but from the theoretical buckling stress times the capacity reduction factor alpha I and then the eta I, which is the plasticity reduction factor, divided by safety factor.

And we use a safety factor of 2.0 for the refueling condition and 1.67 for the post-accident condition, which are consistent with the ASME code and the code case and 280 code.

The boundary conditions for buckling analysis for the pie slice model, essentially there were only core combinations. So we use symmetric-symmetric, asymmetric-symmetric. And I'm going to on the next slide show how the symmetric-symmetric boundary condition would be. What you would see on this slide is the nearby bay has the same symmetric displacement as the main bay.

VICE-CHAIRMAN WALLIS: I have a question about this, too. You have a pie shape. You have a pie shape. So it seems that your buckling shape of the wavelengths are determined by this 36-degree segment. It doesn't allow you to have one which is, say, half goes around, includes two segments in a wavelength, doesn't it?

The fact that you have a pie constrains the kind of item values that you can pick up, does it? You've got this boundary condition which is sort of restricting the modes, isn't it?

Maybe Sandia can explain this to me later on. The fact that you have a pie restricts the buckling modes, doesn't it?

DR. MEHTA: Given this 36-degree segment, we have geometry up to this. And we have taken the worst bay in the sense that the --

VICE-CHAIRMAN WALLIS: There is symmetry around this pie. So it doesn't allow you to have modes which would not have equal behavior on both sides of the pie, right?

DR. MEHTA: Yes. In this case, it's equal behavior, which is the symmetry boundary condition. And the next slide, 29, shows where this could be one direction here, the other direction there. And so that is the asymmetric mode.

And so we did consider it symmetric-symmetric, symmetric-asymmetric, and asymmetric-asymmetric. And so the symmetric-symmetric gives up the lowest item value. That is the lowest buckling load.

MEMBER ABDEL-KHALIK: Are there any buckling modes in which the span can be greater than 36 degrees?

DR. MEHTA: At least the way this is

modeled?

MEMBER ABDEL-KHALIK: No. I mean, look at the symmetric-symmetric, which gives you the largest span, previous --

DR. MEHTA: Previous slide?

MEMBER ABDEL-KHALIK: If you were to do a full 360 degrees, are there any buckling modes in which the span can be greater than one-tenth the entire 360-degree?

DR. MEHTA: I believe in that case, those kinds of modes, you would have a higher item value because in this case, given that we have the 360-degree slice, the boundary conditions we could supply were this. So I believe we are somewhat conservative --

VICE-CHAIRMAN WALLIS: If I crumple a beer can, it doesn't crumple into 36-degree pies. It does something else, right? So you're sort of forcing this thing to crumple into 36-degree pieces symmetrically.

MEMBER SIEBER: Well, it's complicated somewhat by the tank --

CHAIRMAN MAYNARD: First of all, crumpled. We probably should use a crumpled soft drink can, as opposed to a crumpled -- but they don't have pipes running out of them.

MEMBER SIEBER: The connection to the --

MEMBER ARMIJO: The reason 36 degrees was chosen, could you just address --

DR. MEHTA: At that time this was done in the '89-'90 time frame. The competent capability we had was about two orders of magnitude smaller than what we put on the program at that time we had. So that's all we only --

VICE-CHAIRMAN WALLIS: We'll ask Sandia if they got 36-degree --

CHAIRMAN MAYNARD: I understand that it was your position or assumption or guess that larger pie pieces would actually end up with a higher item value, which would be less likely to buckle.

MEMBER SIEBER: I think this is a vertical view. There are ten vents, which means the vents are 36 degrees apart. They represent constraints.

CHAIRMAN MAYNARD: Right.

MEMBER SIEBER: And so the buckling, the big knee of the buckling, is going to be between the vents.

VICE-CHAIRMAN WALLIS: Are they constraints, though? They can move around.

PARTICIPANT: Not much according to this.

MR. GALLAGHER: Dr. Wallis?

MEMBER SIEBER: They do move around. They are not solid, but they are there.

MR. GALLAGHER: Yes. Around the vents, they are stiffened. So that the metal is much thicker around the vents.

DR. MEHTA: And the next slide essentially is --

MEMBER ARMIJO: Dr. Mehta, before you leave those, I still don't understand this. I see like a big sphere, and you're squeezing down on it. And I don't understand. These pictures show us looking down from the top.

MEMBER SIEBER: Right.

MEMBER ARMIJO: If we look from the side, what would it look like? I kind of thought it would buckle in the vertical direction, not in the circumferential direction.

MEMBER SIEBER: I did, too, initially.

DR. MEHTA: I do have one of the buckling modes, which was the limiting one for the buckled shape.

MR. GALLAGHER: Let's show them, Dr. Mehta. Let's show them that. Go to slide 31.

DR. MEHTA: Thirty-one? Okay. This is the buckling analysis. One of the modes for the refueling condition case. Up here the red area is actually moving radially outward. And the new area is moving inward.

VICE-CHAIRMAN WALLIS: So if you looked on the vertical slides, it's buckling in that plane as well?

DR. MEHTA: And also it's moving out here. So it's symmetric with respect to the nearby bay. And so this is what is the theoretical buckle shape, which gives the least buckling load, which is this factor called 6.141. What that says is whatever load we applied for the refueling condition, the theoretical buckling load for this mode is 6.141 times that value.

VICE-CHAIRMAN WALLIS: But the load again you're having a stress only in one direction or something. That's what puzzles me because there are stresses in both directions here, which must both influence the buckling surely.

DR. MEHTA: The model has all of the loading applied to the appropriate nodal loading, so on. So it has exactly --

VICE-CHAIRMAN WALLIS: All the resources are in there, including the tensile ones.

DR. MEHTA: And only for convenience of calculation, what we did was we just calculated a single value of the average stress here just to show that if you take that average stress, multiply by this, that will be the total theoretical buckling load. But we know that the stress here is distributed in a way that it values.

MEMBER ARMIJO: Okay. I understand now.

DR. MEHTA: The next slide shows the asymmetric buckling mode. And in that case, as you will see here, the factor is 6.231, which is higher than 6.14. So essentially that is saying the symmetric-symmetric load would be the least buckling load.

MEMBER ABDEL-KHALIK: So mode one is the limiting one, where you have symmetric-symmetric? Mode three is less high or restrictive?

DR. MEHTA: Right.

MEMBER ABDEL-KHALIK: So the question then is if the span is longer, if you were to take two 36-degree pie shapes and apply a mode one analysis on them with symmetry on both ends of the 72-degree --

MEMBER SIEBER: Right.

MEMBER ABDEL-KHALIK: -- pie shape, would you get a lower load?

DR. MEHTA: I believe you will get a rather higher load than that because that again would capture if we include more of the material, then that would contribute to --

VICE-CHAIRMAN WALLIS: Now, the smaller wavelengths are more unstable? The smaller wavelengths are more unstable? So I could go to a tiny, tiny one? And it would be most unstable? It doesn't make sense somehow. I thought the biggest wavelengths were most unstable.

DR. MEHTA: For example, the 360-degree model would capture all of that. And there what I have seen --

VICE-CHAIRMAN WALLIS: We'll see that.

DR. MEHTA: And what I have seen, I believe, in Sandia would prove that the factors are higher than what we have here.

VICE-CHAIRMAN WALLIS: It would be interesting to see if they get the same kind of pattern that you get. Okay.

MR. OUAOU: Ahmed Ouaou. Dr. Mehta, would you get more information if you described the boundary condition you used for the models that could explain the question whether the mode is going to be lower or higher? The boundary condition you can save it for the pie slice to conclude that the model represents --

VICE-CHAIRMAN WALLIS: It's a symmetric

boundary condition. You're not allowing it to be a 72-degree -- we'll move on. I'm sure it will become clear at the end of the day.

DR. MEHTA: It's my engineering judgment that I believe it would be higher.

Next slide. Here are the details of the summary of the buckling radiation for the refueling case. As you would see up here, the bottom is the 7.59 psi, which is the average value that we calculate for the refueling condition when all the loads were applied.

As you would see in what we saw, the 6.141 was the factor that we got. So if we multiply 7.59 psi by 6.14, this is the theoretical buckling stress like we get. Again, it's a single number that we are looking at.

VICE-CHAIRMAN WALLIS: So the two psi is contributing, the .59 part of this? Yes. The bottom line there, 7.59, you said earlier that the 2 psi contributes about .6. So it's about ten percent of it. It's the two psi.

DR. MEHTA: That's correct.

VICE-CHAIRMAN WALLIS: Okay.

DR. MEHTA: When the capacity reduction factor is 0.207, that indicates that with the reduction by a factor of five for the radius imperfections that could be there and the actual shells.

Now, then we looked at the fact that the geometry of the spherical shell in the sand bed region is such that we applied compressive stress produces hoop tension, which tends to actually straighten out some of the imperfections.

And for that, we went to Dr. Clarence Miller, who was the author of food case and 284. He also currently is the chief engineer at Chicago Bridge and Iron. And he concurred with this approach. He said this approach to take into account that the tensile circumferential stress would raise this factor from above.

And so we calculated this or this circumferential stress that was produced in the sand bed region for the applied building. But was it equal in pressure calculated as if what that tensile stress is in terms of equal in pressure.

VICE-CHAIRMAN WALLIS: Take that away. That's uniform.

DR. MEHTA: Uniform spherical.

VICE-CHAIRMAN WALLIS: You subtracted that? That was a later calculation? You subtracted the uniform stress?

DR. MEHTA: This one was just in terms of if I had a hoop stress --

VICE-CHAIRMAN WALLIS: Right, right.

DR. MEHTA: -- in a sphere, then what the value equal in pressure would be. And then there is a parameter which we go through. And all that indicates is essentially this, the modified capacity reduction factor, is 0.3 --

VICE-CHAIRMAN WALLIS: That's modified by the circumferential stress?

DR. MEHTA: Due to the circumferential.

VICE-CHAIRMAN WALLIS: Okay. Good. Thank you. That's --

DR. MEHTA: All that indicates is that due to the tensile stress in the sand bed region, the actual penalty factor, instead of .207, would be .326. So then if we multiply this number by this number, we get 15.18, I guess.

Since this stress is very small, it's way below the proportion limit. There was the elasticity reduction factor was essentially 1.0. So this when you multiplied by 1.0, we get the inelastic buckling stress, which is 15.18 psi.

And if you apply a factor of safety of

two, then we get this number. It just turns out in this case this number would just about be the value that is required from what we calculated here.

Now, again, this is based on 736 mls of uniform thickness assumed throughout the sand bed region.

MEMBER ABDEL-KHALIK: So without taking credit for the circumferential stress, what would the code safety factor be?

DR. MEHTA: It would be considerably lower. For example, it would be in the ratio of .207 divided by .326. So at least by about the value increased from .207 to .326, which was about 60 percent increased.

And we had consulted Dr. Clarence Miller. He had also written a report. He agreed with this approach that we used. And also he had produced a Welding Research Council bulletin number 406, which came out in 1995, had the same formulas in there which were used in this approach.

VICE-CHAIRMAN WALLIS: I think that's why in the accident load case you're okay because there is a compressive stress in the accident load case, but there's also a significant tensile stress, which probably means it doesn't seem to be a buckling analysis for the accident load case, although there is a compressive stress.

PARTICIPANT: We presented the core accident.

MR. GALLAGHER: We presented the limiting case here, Dr. Wallis, which is --

VICE-CHAIRMAN WALLIS: You did do an accident load case? I don't think Sandia did. Maybe I'm --

MR. GALLAGHER: For the accident pressure load case, Har? Dr. Hardiyal Mehta?

DR. MEHTA: I'm sorry?

MR. POLASKI: The question is, as part of this analysis, did you do a buckling analysis for the other load conditions, for the accident condition? Did you do that analysis?

DR. MEHTA: Yes. We -- oh, for buckling?

MR. POLASKI: Yes, for buckling.

DR. MEHTA: For buckling, we realized that either the refueling or the post-accident condition is governing. We realized that with the large internal pressure, the buckling would not be an issue during the --

VICE-CHAIRMAN WALLIS: That's right. So it's the tensile stress that saves you in that case.

Thank you.

DR. MEHTA: Going to slide 34, as I mentioned earlier, a local area of 12-inch by 12-inch was considered in the modeling to do the sensitivity study. There we produce this 12-inch by 12-inch area to the end of the model to be where you saw the buckled shape, which would tend to produce the largest change in the item value.

And then that was used as a criterion for the locally reduced message, which may be measured during the UT inspection.

VICE-CHAIRMAN WALLIS: And you put it in the worst place, did you? You put it in the worst place as well as having --

DR. MEHTA: Exactly, from effect on the buckling load point of view.

MEMBER SIEBER: Are we to conclude from that that the min. wall thickness varies from point to point as far as the examinations that the licensee is to make and that you just aren't going to apply a constant min. wall for a given elevation in the vessel?

MR. POLASKI: The answer to that is the analysis, as we saw with the colored pictures where the coupling would occur --

MEMBER SIEBER: Yes.

MR. POLASKI: -- those are the areas that were most susceptible to buckling. It was done at a 736 ml uniform thickness. We applied a 736, as I remember --

MEMBER SIEBER: Everywhere?

MR. POLASKI: -- everywhere.

MEMBER SIEBER: Okay.

MR. POLASKI: So in areas other than the limiting buckling areas, we actually had more --

MEMBER SIEBER: You have more margin --

MR. POLASKI: More margin.

MEMBER SIEBER: -- as opposed to allowing a reduction in the required thickness?

MR. POLASKI: Yes.

MEMBER SIEBER: Thank you.

DR. MEHTA: Going on to the next slide, essentially concluding the buckling analysis, conclusions, which were essentially the same measure presented earlier, we used 736 mls uniform cell thickness.

CHAIRMAN MAYNARD: Again I would ask you to speak up a little bit because people on the phones are having a hard time hearing sometimes.

DR. MEHTA: Okay. Thanks.

VICE-CHAIRMAN WALLIS: Can you tell me who is on the phone, out of curiosity?

MR. JUNGE: The State of New Jersey. I think one of the congressmen is listening, Region I, and someone from Rutgers environmental law clinic.

VICE-CHAIRMAN WALLIS: Okay. Thank you.

DR. MEHTA: Essentially this slide summarizes what I had presented for the document evaluation. And next I will be moving on to the asymmetrical section 8 stress analysis.

MEMBER ABDEL-KHALIK: Excuse me. Before we move on, the fact that the locally thinned area -- the placement of the locally thinned area along the symmetry lines for mode one makes that the worst condition. That is not necessarily the case for mode three, is it?

DR. MEHTA: After putting that locally thinned area, we again draw the analysis whatever the lowest mode was. It turned out to be also symmetric-symmetric. And so I'm assuming that there will be higher modes later on.

MEMBER ABDEL-KHALIK: No. I mean, if you were to do the analysis where the locally thinned area is in the middle of one of the peaks for mode three, would the minimum thickness be different than 536 mls?

DR. MEHTA: Well, the same item factor, the minimum thickness, would be different and probably would be even lower because what we had considered was the worst location, the thickness we assumed was 536 mls.

Now, if we consider an area where it is not associated from the worst type of mode shape location point of view, then naturally the area would be even thinner there. That's my --

MEMBER ABDEL-KHALIK: Okay. Thank you.

MEMBER ARMIJO: I think I finally figured out what I was trying to ask a while ago. For this 12-inch by 12-inch area, how thin would the steel have to be in order to lose your factor to safety in this 12-by-12-inch when you have a 12-by-12-inch thinned area?

You know, you say that it has no significant impact of 536. What thickness does it have a significant impact to the point where you would lose your safety factor?

Do you see what I am trying to say? You know, do you have more margin here or is this the very edge or what?

MR. POLASKI: Is there any analysis going to share that's thinner than 536? How thin do you have to go before buckling might actually occur?

MR. OUAOU: Ahmed Ouaou with AmerGen. We do not have any analysis other than the 536 in the 12-by-12 area to demonstrate it.

MEMBER ARMIJO: A judgment question for Dr. Mehta. Do you think it would be -- are you right on the edge at 536 or 400 in a 400 mls 12-by-12-inch area, still have no significant impact or would you have crossed the line?

VICE-CHAIRMAN WALLIS: Of course, it's a hole.

MEMBER ARMIJO: Yes. Well, a hole, you know, for buckling, if it's just a small hole, it won't make any difference. So at some point, so this is an area thickness issue. And I'm just trying to find out how far as we in the locally thinned area --

VICE-CHAIRMAN WALLIS: Well, the vents have been --

MEMBER ARMIJO: But they are stiffened with these giant --

CHAIRMAN MAYNARD: Do you have that information or is that something we need to go back --

MR. GALLAGHER: We don't have a calculation that -- the only thing we can say, as Dr. Mehta mentioned earlier, is that this was about a 9 percent reduction, you know, going to 536. So to get to the safety factor, you have a 50 percent reduction. So you can go lower than 536. We just don't know how much more.

MEMBER ARMIJO: That's what I'm trying to get at. How far as we from --

MR. GALLAGHER: We don't have that analysis.

MEMBER ARMIJO: Okay.

DR. MEHTA: Going on to the ASME code section 8 stress analysis, slide 37. In this, the stress analysis that we conducted according to the ASME code guidelines, also we used one of the allowable stress limits from standard code section 3.8.2 because the ASME code did not have guideline for the forced accident condition allowable stress limits.

The stress limits on safety factors were according to the ASME code. The analysis showed that the ASME code requirements were met. And also later on in this slide, you will see the calculation of the stresses based on the reduced pressure of 44 psi.

That reduction in pressure amounts to about a maximum of 5,200 psi. And the minimum required general and local drywell shell thicknesses, those results are also presented later in this slide.

And all of these are used for the acceptance criteria in the inspection results.

We're going to now the details of this, use the 1962 ASME code section 8 and also 3 code cases which supplemented the requirements in the '62 edition of the code.

The original code also didn't have certain guidance in two areas. One area was whether local areas increased membrane stress due to any thickness reduction as to how far they could be or how the extent of that area could be, which we have to use in the case of '62 psi peak pressure, which was not needed, actually, in the case of 44 psi peak pressure because the stresses come out to be lower. And for the, as I mentioned earlier, post-accident condition, we used the limit from standard plan section 3.8.2.

This slide summarizes the allowable stresses that we used in the code analysis. The three categories are general primary membrane stress, general primary membrane plus bending, and the primary plus secondary.

In the all conditions except the post-accident, the limits are again consistent with what's in the ASME code for level C condition, which is essentially for the accident condition.

And for the post-accident condition, these limits are corresponding to the 38,000 psi general primary membrane is the eave stress and 7,000 is for the primary plus secondary stress.

Going on to the next slide, this slide, the table summarizes the radius calculated stresses and the comparison with allowable values and the percentage margin.

As you will see, they appear. The first column has the thicknesses that were used in the analysis. These are uniform thicknesses in each of the region.

The stress category and then the calculated stress magnitudes are here. And these are the allowable stresses. In this case, instead of 19,300 psi, we used to the extent that the ASME code permits, that the local membrane stress is what's above 110 percent of the general membrane stress limits.

The implication is if in an operating structure you could have to some extent regions in which the stresses between 100 and 110 percent of allowable. So that was used here, which is not necessarily in the case of 44 psi peak pressure, as will be shown later.

This, the last column shows the margins that are with respect to the allowable stress. As you could see, each of these meets the criteria.

VICE-CHAIRMAN WALLIS: Do you have any comment on the size of the margin?

MR. POLASKI: We will address that in the next section on the presentation. It's going to discuss the change from 62 to 44 and how we gained margin in that area.

VICE-CHAIRMAN WALLIS: You will tell us why three percent was okay?

MR. POLASKI: Well, we're going to show you that it's actually a lot more than three percent.

CHAIRMAN MAYNARD: Yes. This is based on the 62 psi.

MR. POLASKI: This is 66.

CHAIRMAN MAYNARD: Okay. Okay. And that extra two psi --

MEMBER ARMIJO: And thank you.

VICE-CHAIRMAN WALLIS: Thank you, Dr. Mehta.

MR. POLASKI: I would now like to introduce Mr. Ahmed Ouaou. Mr. Ouaou was a member of the Oyster Creek license renewal team. He has worked on several license renewal projects, starting with the

Peach Bottom license renewal project.

He holds a Bachelor's degree in civil engineering from the University of Nevada and is a registered professional engineer in California and Pennsylvania. He has over 30 years experience in the design and construction of nuclear power plants.

Mr. Ouaou will be presenting information on the change that was made to the internal design pressure of the drywell. The analysis that was performed by General Electric was at 62 psi internal pressure. And Mr. Ouaou will discuss the change to 44 psi design pressure.

Ahmed?

MR. OUAOU: Thank you, Fred. Good morning.

CHAIRMAN MAYNARD: Good morning.

MR. OUAOU: The analysis that Dr. Mehta described, again, is based on the two psi. And, as Dr. Wallis pointed out, the margin is to be spread a little in certain areas. And to address that question, Oyster Creek investigated the potential of evaluating de-establishing an Oyster Creek-specific design pressure.

The 62 psi was based on generic tests at the day-to-day. And the containment design is somewhat different at Oyster Creek, particularly in the venting from the drywell to the pressure chamber or which decreases the pressure inside the drywell considerably.

Slide 41, please. This slide, again, it was recognized that the pressure is conservative and analysis was conducted in early '90s to establish unique design pressure. That analysis concluded that the peak accident pressure inside the drywell is 38.1 psi. And it was increased by a 15 percent margin and, thus, to 44 psi.

VICE-CHAIRMAN WALLIS: Now, in 1966, there was an overload test of the drywell and vent system, 71.3 psi? You actually tested. It says, "Pneumatic," which seems to me strange. But, anyway, pneumatic test? The whole thing was blown up to see if it would pop. It's loaded inside with a pressure to see if it would -- and so there was a test, which showed that it was good for at least 71 psi.

Is there any kind of a test of this damaged drywell in terms of hydraulic or pneumatic testing?

MR. POLASKI: The only test that would have been done would been the integrated leak rate test. Howie, do you know when that was done last?

MR. RAY: That was done, I --

MR. POLASKI: Introduce yourself.

MR. RAY: Oh. Howie Ray, AmerGen. The next is coming up in 2008. The last one was 1990, I believe, or no.

MR. GALLAGHER: No. Two thousand. We did it in 2000.

MR. RAY: Two thousand, ten years, ten years from 2010.

VICE-CHAIRMAN WALLIS: So you do actually test the drywell under pressure?

MR. GALLAGHER: Right.

VICE-CHAIRMAN WALLIS: And what sort of pressure did you test it at in the 1990-something?

MR. GALLAGHER: It's down to the 44 --

VICE-CHAIRMAN WALLIS: Oh, you tested it at 44 or 44 is a design thing. You actually tested it at 44?

MR. GALLAGHER: Yes. This is the integrated leak break test that's done in accordance with --

VICE-CHAIRMAN WALLIS: Okay. So you did test it. And that test was at 44 psi?

MR. GALLAGHER: Yes, that's correct.

VICE-CHAIRMAN WALLIS: Okay. Thank you.

MR. QUINTENZE: My name is Tom Quintenze. I am the site lead for license renewal at Oyster Creek. We do our integrative leak rate test per our technical specifications. As indicated, it's done periodically. The test pressure that we put that under periodically is 35 pounds pressure. And that's per our technical specifications.

VICE-CHAIRMAN WALLIS: You don't go up to 44, then?

MR. QUINTENZE: That is correct.

VICE-CHAIRMAN WALLIS: But in '66, you went up to 71. It's called an overload test. You don't do overload tests anymore.

MR. QUINTENZE: Okay. In 1966, when the vessel was constructed, there was a test that was done per the start-up testing requirements that were put upon the vendors. And at that point in time, the vessel would have put it into a test, which would have been approximately 1.1 times the design pressure.

CHAIRMAN MAYNARD: I believe that all the nuclear reactors initially built with containments, you do an initial structural integrity test. And the integrated leak rate test that we do every ten years or so is primarily to identify leakage or --

VICE-CHAIRMAN WALLIS: Right. It's a load pressure.

MR. POLASKI: Correct.

MR. GALLAGHER: Tom, thanks for clarifying these pressures. Thanks.

VICE-CHAIRMAN WALLIS: We don't have a test at 44 psi, then?

MR. GALLAGHER: Tech specs at 35.

MEMBER SHACK: If you don't expect failure at 44, there's no way to know what your margin is.

VICE-CHAIRMAN WALLIS: But if you had gone above 44 and not failed, you would know something.

MEMBER SHACK: You still don't know what your margin is.

VICE-CHAIRMAN WALLIS: No, no.

MEMBER SHACK: I mean, the whole question here is to identify margin.

VICE-CHAIRMAN WALLIS: Yes.

MEMBER SIEBER: You only get to do that once.

CHAIRMAN MAYNARD: Do you know, 44 psi, is that what your current safety accident analysis would show your peak pressure to be or is that just what you are now using as your containment design pressure?

MR. OUAOU: The containment design pressure is 38.1. The design pressure is 44. That's in accordance with our current CLB and the approved --

VICE-CHAIRMAN WALLIS: And in an accident, you don't go above that, right, presumably?

MR. OUAOU: Accident, you should not go above 38.1.

MEMBER SIEBER: Thirty-eight, yes.

VICE-CHAIRMAN WALLIS: 38.1.

MR. OUAOU: Right.

VICE-CHAIRMAN WALLIS: Okay.

MEMBER ABDEL-KHALIK: Just for clarification, the integrated leak tests are done at 35 psi A or psi G?

MR. POLASKI: We'll ask Tom to clarify.

PARTICIPANT: G I would hope.

MR. QUINTENZE: I am Tom Quintenze, AmerGen. That should be 35 psi G.

MEMBER ABDEL-KHALIK: Thank you.

MR. OUAOU: The reduction in pressure was approved in a technical specification in 1993. And the reduction resulted in approximately 200 psi and --

VICE-CHAIRMAN WALLIS: Excuse me. When you do these integrated leak tests, you don't put strain gauges on the drywell?

MR. POLASKI: No.

VICE-CHAIRMAN WALLIS: You have no idea

what the stresses are that you generate from this? It would be sort of interesting.

MEMBER SIEBER: You are looking for leaks.

MR. POLASKI: It's a test to measure leakage.

VICE-CHAIRMAN WALLIS: Yes, I know.

MR. POLASKI: You pressurize over time and measure leakage.

MR. OUAOU: As a result of the reduction of pressure, we recalculated the required thicknesses, as I will show you, next slides.

MR. POLASKI: Slide 42, please.

MR. OUAOU: This slide was prepared, I guess anticipating Dr. Wallis' question on the margins, to compare the margin between the 62 psi and the 44 psi. As you can note, there is a lot of margin. The margin increase is significant.

And I would also like to note that the 2006 analysis we did was based on minimum measured thicknesses and an average measure of thicknesses up to the October 2006 refueling outage.

And if you compare the two, there are some differences between what was used in the GE analysis versus what it recorded for 2006 for the cylinder. The original GE analysis, or 1993 analysis, used 619.

And what we used for 2006 is 604 mls thickness.

Next slide, please.

MEMBER SHACK: Just to clarify, so you take the minimum average thickness you measure over your six-by-six grids and you assume that is uniform over the whole shell --

MR. OUAOU: Exactly.

MEMBER SHACK: -- or that region of the shell?

MR. OUAOU: The region, right.

The next slide, we talked earlier about that summarizes the two required thicknesses: local thickness and the general thickness and how they are calculated.

The minimum required general thickness for 44 psi was calculated based on the previous analysis that Dr. Mehta described adjusted for reduction in pressure, from 62 to 44.

Minimum required thickness is based on the ASME code provisions, which allow an increase of one and a half times the allowable stress for local membrane areas. And, as indicated in the bullet there, the area that the minimum local thickness is applied to is less than two-and-a-half-inch diameter. And it also has other provisions in the code that provide you additional guidance.

What happens if you have more than one in a particular area, two inches closer? And how do you get them forced and so on? And we do use those provisions to do the evaluation on a day-by-day basis.

Next slide, please. Forty-four. This slide summarizes the various thicknesses that you use as acceptance criteria. The first column, that's the original nominal design thickness, second column is the minimum measured general thickness 2000 through 2006. The third column is the minimum required general thickness for the pressure for the membrane stresses 452.

I would like to point out that in the sand bed region, relatively required thickness is buckling. And that's 47.36 mls. On the 479 is required for pressure really does not enter into the picture because the pressure --

VICE-CHAIRMAN WALLIS: These figures are based on the ASME allowable loads. They're not based on a yield stress. So there's a big factor of safety in here presumably.

MR. OUAOU: There is a factor of safety, 2 and 1.67 --

VICE-CHAIRMAN WALLIS: The actual

thickness before anything yields is considerably less than we show here presumably.

MR. OUAOU: The last column is the minimum required thickness.

VICE-CHAIRMAN WALLIS: By ASME, right.

MR. OUAOU: By ASME. Slide 45, please. This slide summarizes the analysis that I just described to you. The drywell shell, thin drywell shell, was analyzed in accordance with ASME and the requirements.

The stress limits are in accordance with the code considering all load-to-load combinations. To begin the margin, what we pursued, the change in design basis was approved to reduce pressure from 44 psi to 62 psi.

That resulted in considerable margin that I shared with you in the last slide. And those as a result of -- you know, following the approval of the reduction of pressure, we calculated the requirement of thicknesses which will be used to monitor against going forward.

MR. POLASKI: Thank you, Ahmed.

That completes our presentation on the thickness that was performed on the drywell shell thickness.

CHAIRMAN MAYNARD: I think before we go to the next segment, we're at the point in the agenda for a break. So we'll take a 15-minute break here and then come back. We'll come back at five till.

(Whereupon, the foregoing matter went off the record at 10:39 a.m. and went back on the record at 10:57 a.m.)

CHAIRMAN MAYNARD: I would like to restart the meeting here. So we'll turn it back over to you for the next segment in the presentation.

MR. POLASKI: Thank you, Dr. Maynard.

The next part of our presentation, we've got corrosion in the sand bed region. As I discussed previously, the sand bed region is that part of the drywell where corrosion is reduced to shell thickness resulting in the smallest margin to the code-allowable thickness.

As you heard in Dr. Mehta's and Mr. Ouaou's presentation on the drywell thickness analysis, AmerGen has established the thickness needed for the drywell to meet the ASME code design thickness with the safety factors required by the code.

This section of the presentation will present information on the history of the corrosion with drywell shell in the sand bed region, including corrective actions that have been taken in the current condition of the drywell shell in the sand bed region.

We will provide information on the coding that was applied to the exterior surface of the drywell shell in the sand bed region. We also provide information on the statistical analysis performed and the UT thickness measurements that are made to determine the thickness of the drywell shell.

Finally, we will provide the results of inspections performed during the recent refueling outage in October 2006. We believe that this information will support AmerGen's position that the Oyster Creek drywell shell meets its ASME code design thickness and that AmerGen has the aging management programs in place to ensure that the drywell shell will continue to meet its design requirements.

We would now like to introduce Mr. John O'Rourke, who will lead the presentation on the sand bed region. Mr. O'Rourke holds both Bachelor's and Master's degrees in mechanical engineering from Drexel University. He is a registered professional engineer.

Prior to joining the Oyster Creek license renewal project, Mr. O'Rourke was the Assistant Engineering Director at Oyster Creek. He previously held various engineering and management positions in

Exelon's Nuclear Engineering Department. And he has over 30 years' experience in nuclear power.

Mr. O'Rourke?

MR. O'ROURKE: Thanks, Fred.

C. DRYWELL SAND BED REGION

MR. O'ROURKE: This part of the presentation will discuss the sand bed region and will support the following conclusions. First, corrosion on the outside of the drywell shell in the sand bed region has been arrested.

Fred had previously discussed the cause of the corrosion and the corrective actions taken. And we will shortly show you the ultrasonic measurement data and the train graphs that support this conclusion.

Our second conclusion is that the coating shows no degradation. And we have shown you one photo. We'll show you some additional photos of the coated shell to support this conclusion.

Thirdly, there is sufficient margin to the minimum thickness requirements. Along with the ultrasonic measurement data we will present the available margins with the minimum margin being 64 mls.

After the corrosion problem was

discovered, over 500 ultrasonic measurements were taken from inside the drywell. Three hundred sixty degrees around the drywell had elevation 11-foot-3, which is within the sand bed region on the outside and just above the floor and curb on the inside of the drywell.

When thin locations were identified, ultrasonic measurements were taken to locate the thinnest locations. We then did grid measurements at the thinnest locations and selected 19 locations for continued corrosion monitoring, with at least one of those grids being in each of the 10 bays.

What is shown now is a plan view of the drywell showing the locations of the 19 monitored points shown as magenta squares. Also, note the trenches in bays 5 and 7 that I will later discuss in a presentation. However, these were trenches that were excavated in 1986 as part of the corrosion investigation.

The next slide shows an elevation view showing the typical grid locations where the ultrasonic measurements were taken from inside at elevation 11-foot-3. This is the graphical response to Dr. Shack's question earlier about where we took the measurements.

The next slide, 51, this is a detailed view of the bay 5 trench excavation. And it also shows the additional excavation that we did in the outage.

VICE-CHAIRMAN WALLIS: Can we go back to the picture you just showed with the magentas and all of that? You have taken these measurements under the vent pipe because presumably the curve prevents you from going in the other area.

MR. O'ROURKE: That is correct.

VICE-CHAIRMAN WALLIS: So we don't know what is happening in the lowest region between the vent pipes --

MR. O'ROURKE: Only in the trenches. And we'll --

VICE-CHAIRMAN WALLIS: -- or didn't you measure from the other side in that region?

MR. O'ROURKE: At this point, when we were taking these measurements, the sand was still in the sand bed region.

VICE-CHAIRMAN WALLIS: Okay. At this point.

MR. O'ROURKE: Yes, yes.

VICE-CHAIRMAN WALLIS: But later on you got measurements in the area between the vent pipes?

MR. O'ROURKE: Yes, from the external.

VICE-CHAIRMAN WALLIS: The outside?

MR. O'ROURKE: That's correct. Back to slide 51, showing the details of the excavation in bay 5; and slide 52, which shows the excavation in bay 17.

VICE-CHAIRMAN WALLIS: Do you see the ones that later had water in them, these trenches?

MR. O'ROURKE: Yes. As I previously noted, trenches in bays 5 and 17 were excavated in 1986 to determine the corrosion in the sand bed region at elevation below the drywell interior floor. Bays 5 and 17 were selected because ultrasonic measurements indicated that these bays had the least and the most corrosion, respectively.

The trenches extend to about the elevation of the bottom of the sand bed, as I showed in the previous two slides. Ultrasonic measurements were taken in the trenches, confirmed that the corrosion below elevation 11-foot-3 was bounded by the monitoring at elevation 11-foot-3. And in the next slide, we'll show you the ultrasonic measurement data.

This slide summarizes the measurements taken during the 2006 outage. And, as you can see, the bay 17 trench data on the right is bounded by the monitoring locations, particularly 17A, 17D, and the two to the right of those. You see that the 17A top shows considerably more thickness. This is indicative of the air-sand interface that we had shown on a previous photograph.

Bay 5 did not exhibit as much wall loss. The trench numbers represent some corrosion that occurred prior to the coating of the external shell and the refinishing of the floor in the sand bed region. And ongoing corrosion is bounded by the monitoring at elevation 11-foot-3.

Slide 55, to summarize the corrective actions for the sand bed region, we removed the sand. We cleaned the shell. We took ultrasonic measurements externally. We coated the shell. And then we performed ultrasonic measurements internally as the baseline for future monitoring.

I would now like to show you a couple of photographs of the condition of the drywell shell after the sand removal. This photograph, which we had shown earlier, indicates the condition of the shell following sand removal and prior to cleaning of the shell.

VICE-CHAIRMAN WALLIS: It looks to me as if some of the rust has come off because there's a sort of a cliff there where you see the rust.

MR. O'ROURKE: Any of the rust that had fallen off it was part of the --

VICE-CHAIRMAN WALLIS: Almost fallen off because there is a real layer of rust which suddenly in the bottom right-hand there which --

MR. POLASKI: I think what you have to remember is this is a picture in the sand bed region after the sand had been removed. So there had been people in there working to remove the sand and clean the --

VICE-CHAIRMAN WALLIS: And after that, they took some rust away as well.

MR. POLASKI: They could have knocked some off and moved some of it because you will note on here where it still shows against the drywell shell down at the bottom, which is where you think it would -- expect it to be retained the longest before you actually went in to clean it off.

MR. O'ROURKE: Moving on to photo 58, another photo of the shell in the sand bed floor prior to the repairs. And you can see in the floor the exposed rebar due to the finished condition of the floor.

CHAIRMAN MAYNARD: Now, that was from original construction or was that something that occurred after original construction?

MR. O'ROURKE: We believe that is from original construction. Once the sand was in there, there was no other access to that area.

MR. POLASKI: And the reports indicate that from when they removed the sand, the floor in some of the bays had been properly finished and were in good condition. Other bays were six to eight inches lower than they should have been, having never been completely constructed.

MEMBER ARMIJO: The area where the rebar was exposed, did that happen to be in a bay where there was very little corrosion in the sand bed area or where there was a lot of corrosion in the sand bed area?

MR. O'ROURKE: It varied between bays. Some bays showed damage, and some did not.

MEMBER ARMIJO: So what I'm trying to get at is, if you saw exposed rebar, it had nothing to do with the corrosion in the sand bed area because there were some areas -- you know, if you had seen exposed rebar in areas where there was no sand bed corrosion, then you would say clearly that was there before construction and it couldn't have been caused by the water.

MR. GALLAGHER: Yes. Pete, do we have that correlation?

MR. TAMBURRO: This is Pete Tamburro. It varied. There was no relationship between the severe corrosion on the vessel and the degradation of the floor.

MEMBER ARMIJO: Did you see exposed rebar in regions where there was no corrosion of the vessel?

MR. TAMBURRO: Yes.

VICE-CHAIRMAN WALLIS: What are we looking at on the right of this picture here? It's corrugated.

MR. TAMBURRO: That's the rebar.

VICE-CHAIRMAN WALLIS: On the right-hand side is rebar?

MEMBER SIEBER: It's rebar.

MR. GALLAGHER: That's the frame. Ahmed, please describe the frame.

MR. OUAOU: Ahmed Ouaou with AmerGen. On the right-hand side, what we have is a conduit through which rebar is the main reinforcement for structure --

VICE-CHAIRMAN WALLIS: So we are looking at, those ribs are rebar on the right-hand side?

MR. OUAOU: They're rebar. That's correct. Yes.

MEMBER SIEBER: What's the general scale of this picture? Is that like six inches from the --

MR. GALLAGHER: Yes. These pictures are really hard to get perspective on, but, as we said, the sand bed region was 15 inches wide, right? But there are a lot of optical illusions and things like that --

MEMBER SIEBER: Right.

MR. GALLAGHER: -- in these because the shell curves, you know.

MEMBER SIEBER: That's about 15 inches, the dark area there.

MR. GALLAGHER: From left to right would be about 15.

MEMBER SIEBER: Okay. Thanks.

MEMBER ABDEL-KHALIK: Was the rebar itself significantly corroded?

MR. POLASKI: Pete, can you address that?

MR. TAMBURRO: No, the rebar was not significantly corroded.

VICE-CHAIRMAN WALLIS: It looks corroded, though.

MR. TAMBURRO: This picture really is tinted poorly.

MR. GALLAGHER: Now, for clarity, are you talking about the rebar in the floor?

MR. TAMBURRO: Yes.

VICE-CHAIRMAN WALLIS: The rebar on the side looks really --

MR. GALLAGHER: Now, there are two different things here. The side if I can answer that first, the side, those, the rebar is encased in pipe. Okay. So you're --

VICE-CHAIRMAN WALLIS: Actually, the conduit, it's the conduit we see.

MR. GALLAGHER: You're looking at the pipe. The rebar --

VICE-CHAIRMAN WALLIS: The conduit has disappeared in places.

MR. GALLAGHER: The rebar in the floor -- well, no. There are individual pipes there, Dr. Wallis, so that it looks like a ribbed configuration. But there are individual pipes. The rebar in the floor is not load-bearing structural rebar. So, you know, it is not a significant --

VICE-CHAIRMAN WALLIS: But if I look at the pipes, the fifth one alone, it looks as if it's disappeared. It looks very, very corroded in my picture here.

MR. GALLAGHER: The fifth one?

VICE-CHAIRMAN WALLIS: The fifth one in, yes. You see there's an edge to it. The bottom of it seems to have disappeared.

MR. GALLAGHER: I don't think we can comment on that particular one at this point.

CHAIRMAN MAYNARD: Now, is that rebar or is that actually like fidgeting cables that run through those conduit?

MR. OUAOU: It is rebar. It's almost treated like you suggested, with like a tendon, but what really happened is that the main concrete was much to provide the area. And, as a result, rebar was exposed for the reason that it was encased in these conduits that we're looking at, but it's actually grouted inside. So if the conduit corrodes, the rebar function is not going to be impacted.

MR. O'ROURKE: And, just to summarize, this is the condition of the floor after the removal of the sand. So we believe that these were unfinished and not as a result of --

VICE-CHAIRMAN WALLIS: Did the NRC go into this space?

CHAIRMAN MAYNARD: It is my understanding that during the inspection in 2006, an NRC inspector did go into these areas.

MR. ASHLEY: Yes, sir. He's here today.

VICE-CHAIRMAN WALLIS: Did he look at the rebar and the conduit? And was it as corroded as it appears to be here?

CHAIRMAN MAYNARD: Tim O'Hara?

MR. O'HARA: Good morning. My name is Tim O'Hara from Region I. I was on site during the entire inspection. I entered two of the sand bed bays, which allowed me to look at approximately four total bays.

You can look to the side and see them. I also reviewed all of the visual inspection records. And the licensee did document all the conditions they found in there, including the condition of the sand bed floor and so forth.

VICE-CHAIRMAN WALLIS: And the rebar?

MR. O'HARA: And the rebar, yes.

VICE-CHAIRMAN WALLIS: And did you see the extent of the corrosion of the rebar?

MR. O'HARA: I don't think it was extensive.

VICE-CHAIRMAN WALLIS: The extent of it? Because in this picture, it just looks --

MR. O'HARA: That wasn't the intent of the inspection.

VICE-CHAIRMAN WALLIS: Yes.

MR. O'HARA: We were looking at the coating on the drywell, but the general condition was looked at and noted. Any conditions that the licensee thought were not correct were put in their corrective action process and analyzed.

MR. GALLAGHER: And, remember, this picture is from 1992, Dr. Wallis.

MEMBER SHACK: I mean, I thought these floors were finished up to make them smooth, to make sure that you can drain the water. So, I mean, it presumably doesn't look like this anymore.

MR. GALLAGHER: Yes. These pictures are from 1992. That's correct.

MR. POLASKI: As we go on to the next several slides, we will show you what it looks like today or what it looked like in '92 after the --

MR. O'ROURKE: And slide 59 leads us into those photographs. We'll show you the condition of the drywell shell as repairs were in progress.

Slide 60 shows the photograph of the shell after cleaning and the corrosion products removed. It also shows the sand bed floor after the coating was applied. That's a partial answer to Dr. Shack's question.

The next photograph shows --

VICE-CHAIRMAN WALLIS: What's that thing in the background? It looks like a sheet of plastic or something. What is that?

MR. POLASKI: Yes. That very well could be plastic. You remember these pictures were taken during the actual application, repairs still in launch. So you will see plastic in that area.

VICE-CHAIRMAN WALLIS: Well, the sand bed floor needed quite a bit of repair it looks like.

MR. O'ROURKE: Slide 61 shows the shell as it's being coated with the primer coat and also again a view of the sand bed floor.

Slide 62 shows the shell after the epoxy coating was applied. It also shows the caulk seal that was applied to the interface between the external shell and the sand bed floor.

And I will note that there are some additional photos in your reference books.

MEMBER ARMIJO: Was that caulk sealing kind of pressurized to kind of get it into the gap or was it just kind of surface, like you do with a bathtub or something?

MR. O'ROURKE: Pete, do you have an answer to that question?

MR. TAMBURRO: The caulk ceiling was a

fairly viscous epoxy caulking. And it was forced into that gap with a trowel and pushed in there.

MR. GALLAGHER: Thanks, Pete.

VICE-CHAIRMAN WALLIS: So if there's no water there, it doesn't matter, does it?

MR. O'ROURKE: That's correct.

I'm looking at slide 63.

VICE-CHAIRMAN WALLIS: How about the draining of the sand bed floor? It presumably has to run around circumferentially to find a drain. Did you worry about leveling it off or putting a slope on it or it slopes to the drain or what? How did you do that?

MR. O'ROURKE: That is correct. The directions were to slope. When the floors were finished, the direction was to slope it away from the drywell and toward the drain.

VICE-CHAIRMAN WALLIS: All right.

MR. O'ROURKE: And remember Fred's earlier discussion that there are five sand bed drains, --

VICE-CHAIRMAN WALLIS: Right.

MR. O'ROURKE: -- as opposed to the one on the --

VICE-CHAIRMAN WALLIS: The one on the top, right.

MR. O'ROURKE: -- the unique trough up above. Continuing with the background and history for the sand bed region, the epoxy coating applied to the external shell was a three-part coating system designed for applications on corroded surfaces.

The first coat that I showed in a previous slide in the photograph was a rust-penetrating sealer designed to penetrate rusty surfaces, reinforce the rusty steel substrate, and ensure adhesion of the epoxy coating.

Two coats of epoxy coating were then applied. This coating is designed for more severe surfaces than we expect at Oyster Creek, a couple of which are noted on the slide.

Prior to application of the coating, it was tested in a mock-up for coating thickness and absence of holidays or pinholes. And we used two coats to minimize any chance of pinholes or holidays. And the coats are of a different color to facilitate future inspections.

Fred?

MR. POLASKI: Thank you, John.

I would now like to -- you have heard from Mr. O'Rourke about the corrective actions taken to stop the corrosion of the drywell shell in the sand bed region. One of the key aspects of the corrective action was application of the epoxy coating to the exterior surface of the shell.

Our next presenter is Mr. Jon Cavallo, who will speak about the coating on the drywell shell. Mr. Cavallo is the Vice President of Corrosion Control Consultants Alliance Incorporated. He's a registered professional engineer in six states and holds a Bachelor's degree from Northeastern University in Boston, Massachusetts.

He also is a Certified society of Protective Coatings protective coatings specialist and holds registration as a certified protective coatings engineer from the National Board of Registration for Nuclear Safety-Related Coating Engineers and Specialists.

He is active in a number of technical societies, including ASTM, National Association of Corrosion Engineers, National Society of Professional Engineers, and the Society of Protective Coatings.

Mr. Cavallo served as the editor of the EPRI report "Guideline on Nuclear Safety-related Coatings Division I," assisted in development of and teaches EPRI code in his training courses. He's also the principal investigator of the EPRI report

"Analysis of Pressurized Water Reactor on Qualified Original Equipment Manufacturer Buildings" and since 2000 has been a member of the NEI PWR containment sump task force.

Mr. Cavallo?

MR. CAVALLO: Thanks, Fred. Good morning, gentlemen.

I was asked to take an independent look at the approach that Oyster Creek has taken to mitigating the corrosion on the exterior shell of the drywell in the sand bed region.

First off, I went back and looked at the background and history from a regulatory standpoint of good guidance that we received to approach this project.

The Oyster Creek protective coatings monitoring and maintenance program, aging management is consistent with NUREG-1801, which is a GALL report volume II, appendix XI.S8, which is the appendix devoted to coatings condition assessment. However, you should note that that appendix only covers coating service level I coatings, which is coatings inside of the primary pressure boundary inside the drywell.

Oyster Creek in my opinion wisely extended that requirement to the service level II coating, which they applied to the exterior of the drywell using many of the same quality approaches that are used in containment coatings.

Next slide, please. The coatings applied to the exterior of the drywell, which we have seen some photographs of in the previous presentation, coating service level II, the evaluation and continued monitoring of those coatings are conducted in accordance with ASME section 11, subsection IWE by qualified VT inspectors. In other words, they are inspected the same way using the same techniques that are used inside the containment, both BWRs and PWRs.

The coated areas are examined at a minimum for visual anomalies, which includes flaking, blistering, peeling, discoloration, and other signs of distress. This approach is consistent again with the NUREG-1801 and its attendant ASTM standards.

The whole premise of ASME section 11, which is used for examination of the pressure boundaries in PWRs and BWRs, is the degradation of a vessel that's got a coating on it will be indicated by a visual precursor defect in the coating.

And, again, the ASME section 11, subsection IWE protocol is to remove that coating and examine the substrate. That way we have a consistent manner to look for any continuing corrosion of the drywell shell on the exterior there, the sand bed region.

Now, I wanted to spend a little time discussing how barrier coatings such as the one that John described prevent corrosion of the scale substrates.

Basically we have four conditions necessary for metallic corrosion: an anode; a cathode; an electrical conductor; and some type of an electrolyte, which is a liquid that conducts electricity.

We as coatings engineers can only do one thing. We can't control the anodes. We can't control the cathodes. We can't control the electrical conductors because they were already inherently in the steel. So what we do is apply a barrier coating system, which isolates the moisture, the electrolyte, and breaks the corrosion cycle.

This is what has been done in the Oyster Creek sand bed region. Repeating what John told you, the Oyster Creek sand bed region coating system is really a three-step process.

First off, the surface preparation was done in accordance with SSPS SP2 hand tool cleaning, which I think gets back to Dr. Wallis' question about what was done. That removes loose rust, loose mill scale, and loose coating. And loose is defined as determined by moderate pressure with a dull putty knife by code.

With that level of surface prep, which was appropriate, they then applied a pre-prime, which is an epoxy, which penetrates into the semi-irregular shape of the substrate, and then applied two coats --

VICE-CHAIRMAN WALLIS: About that pre-prime, it is a very key thing, isn't it? I mean, if you leave too much dry rust on, then it doesn't really adhere to the steel.

MR. CAVALLO: Exactly. I am going to in a little bit talk about how this was controlled as a special process similar to welding.

VICE-CHAIRMAN WALLIS: Okay. Okay.

MR. CAVALLO: I didn't mean to cut you off, sir.

VICE-CHAIRMAN WALLIS: No, no. I just wanted to focus on that particular thing. The pre-prime is an important step in this.

MR. CAVALLO: Yes, sir, it is, absolutely. And, remember, our coating systems such as this one are actually designed. I mean, people think anybody can paint. It's not true.

So we have selected a system with good history in this type of application. Then we applied two coats of the Devran 184 epoxy, which is a standard epoxy phenolic, which is used a lot for this region, which provides that barrier for moisture.

And, finally, we saw pictures of the Devmat 124S caulking, which was applied by troweling into the interface between the concrete floor and the steel substrate, again another moisture barrier.

MEMBER ARMIJO: Just to understand, the pre-prime, is it intended? Is it preferred that it be in contact with the metal or is it okay that it's in contact with a surface oxide that is adherent to the metal?

MR. CAVALLO: Both, actually. It's designed as an adhesion promoter. It soaks into any crevices in that remaining corrosion. And, remember, this is very tightly adherent corrosion and mill scale.

MEMBER ARMIJO: Right.

MR. CAVALLO: And also it's an epoxy polyamine. So it does bond to the steel substrate that may be exposed. So you have a combination of both conditions. And it is an adhesion promoter and gives something for the next two coats to stick to.

VICE-CHAIRMAN WALLIS: You mean if you have a pit, it just bridges over the pit, does it?

MR. CAVALLO: No. It actually soaks in. It's a fairly slow-drying material. And it acts a lot like our old bridge paint did. It's to simulate that.

Now, my conclusion is in basically reviewing the approach and the engineering involved is that this coating system is appropriate for the intended service, which is to prevent further corrosion of the steel in the sand bed region drywell shell.

Some of the reasons I came to that conclusion are that we have created now a very benign corrosion environment. Before the sand was removed, we actually almost had an emergent condition. We had moisture trapped in there held against the surface by the sand. Now we have a dry --

CHAIRMAN MAYNARD: I'm sorry. Can you wait just a minute? We're trying to get this muted. We are getting some noise from one of the lines. So if the people on the telephone will be quiet, we'll go ahead and continue with the discussion. Go ahead, Jon.

MR. CAVALLO: All right. So, anyways, we

have removed all the sand. We removed the water. We have a benign environment, a fairly low radiation dose rate. So I don't worry about any sort of radiation damage. This coating typically good to 1 times 10^{9} rads or more total lifetime dose. And we're never going to see anything like that.

Finally, it's an enclosed space. It's shielded from atmospheric moisture, shielded from the site environment. So we have now a very benign environment.

The coating system is compatible with that environment. Back to your question about the adhesion promoter, that adhesion promoter which is your penetrating sealer is designed to adhere to a minimally prepared surface is what we're talking about here, where we're leaving some corrosion product behind. And also the two-coat applied over top of that is used an awful lot in chemical tanks. So our environment is far less severe than that.

And, then finally, this coating system can be successfully applied by brush and roller. Because of their very tight environment, we couldn't get into very sophisticated spray equipment, such things like that. So this is appropriate to be applied that way.

Now, Oyster Creek also did something which

I think is quite noteworthy. They actually create a mock-up of the sand bed region with the drywell shell before they actually applied the coating in service. And they did surface preparation and coasting application using the same mechanics in this mock-up area with the restricted access.

This was a proof of principle on the coating system and also was used to train the mechanics who did the surface prep and the coating work. This includes the caulking also.

And then, finally, what they did was actually do a holiday test, which was an electrical test, to see whether or not they had pinholes on this mock-up. So this was treated very similar to a special process like we would have for welding. So it was well over and above what you normally see in an outside containment coating's work effort. So there was quite a bit put into that.

MEMBER SIEBER: So a holiday as referred to in your previous slide is a pinhole?

MR. CAVALLO: Yes, sir. And usually holidays are not visible. They're solvent blistering.

Now, I am going with periodic condition assessment maintenance if there is any required. And I am not sure there ever will be any. In my opinion, the Oyster Creek sand bed region shell coating will continue to perform satisfactorily for the life of the plant, very similar to our other coatings in the world of nuclear reactors.

What Oyster Creek is going to do is inspect or they have inspected 100 percent of the sand bed region drywell shell coating during the 2006 outage. And they will continue to do this inspection on a periodicity of three bays every other outage with all ten bays inspected every ten years.

Now, this ten-year cycle is in accordance with recommendations that industry has published, including the EPRI guideline in protective coatings, where for coating service level II coatings, these coatings outside containment in a benign environment, we recommend a periodicity of inspect them all every ten years due --

VICE-CHAIRMAN WALLIS: Can I ask, this is presumably a tough ductile type of coating? It's not brittle in any way?

MR. CAVALLO: Absolutely not. It's --

VICE-CHAIRMAN WALLIS: As the steel moves during pressurization and so on, it's not going to crack?

MR. CAVALLO: No. Actually, the coatings

condition, if you think of a storage tank, we have something called oil canning, where it actually moves up and down quite a bit. So we've got to get very little movement here. So yes, it is appropriate.

MEMBER ARMIJO: So this has been on for 14 years already, right, due to 2006 and -- are we going to talk anymore about the inspection of the coating or is this it?

MR. POLASKI: We are going to later --

MEMBER ARMIJO: In 14 years, have you seen the need to repair it or repaint it or whatever?

MR. POLASKI: No. We're going to -- I'll let Mr. Howie Ray present that. Howie is going to present information on inspection results.

MR. RAY: Yes. We've done visual inspections on all ten bays in 2006 by qualified individuals. And the coating was found to be satisfactory. And we do it on a monitoring basis to make sure that we're planning the recoating before we're filled.

MEMBER ARMIJO: If you had found some defects, it is repairable?

MR. CAVALLO: Yes, sir. Yes, sir. This is a repairable coating.

MEMBER SIEBER: Let me ask another

question. In your professional opinion, is a ten-year interval adequate for this application in these conditions?

MR. CAVALLO: Yes, sir. Based on -- I edited the document that the ten-year quote comes out of. So that is my professional opinion.

MEMBER SIEBER: Okay.

MEMBER SHACK: You did see some degradation in the coating on the floor, though, right? Did I read that somewhere?

MR. GALLAGHER: No. What you might be thinking about, Dr. Shack, is there was between the floor and the wall, not the containment shell, the back side wall, a gap in a couple of places. And that was repaired

MR. POLASKI: Are there any other questions on the coating system?

(No response.)

MR. POLASKI: Jon, thank you.

MR. CAVALLO: You are welcome.

MR. POLASKI: The next part of our presentation is going to cover the methods that are used to make UT thickness measurements drywell shell and how this data is analyzed.

Presenting this information will be Mr.

Pete Tamburro. Mr. Tamburro holds a Bachelor of Science degree in chemical engineering from Clarkson University and a Master's degree in computer science from Dickerson University.

He is a professional engineer who holds a professional engineer's license from the State of New Jersey. He has worked in the nuclear industry since 1980 and has 25 years experience at Oyster Creek and Three Mile Island. He has worked on the drywell corrosion issue since 1988, mostly dealing with data collection analysis and documentation.

Mr. Tamburro?

MR. TAMBURRO: Thank you, Fred. I am here to tell you what we did with the 2006 data.

This slide 72. First I would like to present some background history. In 1992, the sand was removed and the coating applied. We performed a baseline inspection on the 19 monitor locations.

VICE-CHAIRMAN WALLIS: Can you go back over how those locations were selected?

MR. TAMBURRO: Yes, sir. In the mid '80s, when we recognized that there was a problem, we did an extensive investigation from the inside and did over 500 UT inspections throughout the --

VICE-CHAIRMAN WALLIS: Five hundred on

that side?

MR. TAMBURRO: Yes, sir. Those 500 identified the thinnest areas. We then characterized those areas and expanded those areas to a six-inch by six-inch area, which we monitor now.

VICE-CHAIRMAN WALLIS: And do you monitor it by monitoring all over it or one spot in it or what?

MR. TAMBURRO: We monitor it by taking a series of inspections --

VICE-CHAIRMAN WALLIS: So it's not just one reading?

MR. TAMBURRO: No, sir.

VICE-CHAIRMAN WALLIS: It's a whole lot of readings at --

MR. TAMBURRO: It's a lot. It's 49 readings.

VICE-CHAIRMAN WALLIS: Okay. That helps.

MR. TAMBURRO: And I will get into that in --

VICE-CHAIRMAN WALLIS: Why is it only at one elevation? Why not at several elevations? Because there is an area involved. Why is it all at 11-foot, 3 inches?

MR. TAMBURRO: The 11-foot, 3-inch area

was inspected because of the limited access due to the concrete curb on the inside.

MR. GALLAGHER: Yes, Dr. Wallis --

VICE-CHAIRMAN WALLIS: It's the lowest you could get to. It's the lowest you could get to, isn't it? Yes. It's the lowest you could get to in there. But on the outside, you can get lower than that.

MR. TAMBURRO: Yes, sir. And we have inspected externally lower than 11-foot, 3.

MR. O'ROURKE: And this is a graphical representation we showed earlier.

VICE-CHAIRMAN WALLIS: Outside you can get lower than that because --

MR. GALLAGHER: Yes. Dr. Wallis?

VICE-CHAIRMAN WALLIS: -- generally the corrosion might be worse lower down.

MR. O'ROURKE: That's correct, on the outside.

VICE-CHAIRMAN WALLIS: On the outside. And so you can get lower than that outside?

MR. TAMBURRO: Yes, sir.

MR. GALLAGHER: Yes. And, Dr. Wallis, just --

VICE-CHAIRMAN WALLIS: Just tell us about that.

MR. GALLAGHER: Yes. But visually if you just want to look at it real quickly, on page 101 -- now, it's hard to see when it flips up here, but we also included that chart in your handout book, the last page of your reference material. There's an 11 by 17 depiction of this.

VICE-CHAIRMAN WALLIS: Whereabouts is that?

MR. GALLAGHER: And we're going to go through all of this.

VICE-CHAIRMAN WALLIS: You are going to go through that later on?

MR. GALLAGHER: Yes. We're going to go through all of this. But what this is is this is a graphical representation of all the data in the sand bed region in 2006. And you can see the coverage is pretty wide. This includes the grids, the trenches, and the individual points.

VICE-CHAIRMAN WALLIS: Okay.

MR. GALLAGHER: And we are going to explain each one of these as we go through this section right here.

VICE-CHAIRMAN WALLIS: Okay. Thank you.

MR. GALLAGHER: That summarizes that --

VICE-CHAIRMAN WALLIS: I don't want to

hold you up. So we'll get to that, right?

MR. TAMBURRO: Okay. On slide 72, in 1992, we found that our thinnest average reading over a 6-by-6-inch area was 800 mls. And our thinnest individual reading, which was measured from the outside, was 618 mls. Then when you compared them to the appropriate acceptance criteria, they both met the acceptance criteria.

Moving on to --

VICE-CHAIRMAN WALLIS: That's over half an inch less than it started out at or about a half an inch less?

MR. TAMBURRO: Yes, sir, at the thinnest areas. Yes, sir.

Slide 73. In 1994, we repeated the inspections on the 19 grids. And in 1996, these inspections showed no statistical changes in the means and the thinnest area and the thinnest individual points. This became the basis for the conclusion that the corrosion had been arrested.

MEMBER ARMIJO: I guess I looked at a different set of data. It looked to me like all your 1996 measurements were much higher than the previous measurements.

MR. TAMBURRO: Yes, sir. There is an

anomaly with the 1996 data in which they are higher. Yes, sir.

MEMBER SIEBER: What do you think causes that?

MEMBER ARMIJO: Yes. Right.

MR. TAMBURRO: We've taken some analysis. And we have had our NDE folks look at what some of the potential reasons were. They have indicated that a couple of potential reasons were that the contractors that did the '96 inspections did not remove the grease that was on the locations that could attribute to it.

There are other factors, such as not putting the machine, the UT machine, in the proper setting. However, we cannot positively confirm why we had this --

MEMBER SIEBER: It's an epistemic error?

MR. TAMBURRO: Yes, sir.

MEMBER SIEBER: And it looks like a bad calibration, wrong block, or perhaps a miscalibration?

MR. TAMBURRO: Yes, sir.

MEMBER SIEBER: But it's systematic across all of the readings?

MR. TAMBURRO: However, the 2006 data has come in line and is consistent with the 1992 and 1994 values.

MEMBER SIEBER: Well, the '94 is the ones that are off, right?

MR. TAMBURRO: No, sir. The '96 --

MEMBER SIEBER: '96.

MR. TAMBURRO: -- are the ones that are off.

MEMBER SIEBER: Okay. Well, that's a problem, I guess, as I see it, because somebody around the 1996 time frame should have caught that --

MR. TAMBURRO: Right.

MEMBER SIEBER: -- to figure out why that was that way --

PARTICIPANT: At the time, during the inspection.

MEMBER SIEBER: -- and corrected it because if you do it again, that could give you --

MR. TAMBURRO: Yes, sir.

MEMBER SIEBER: -- bad data. And you're relying on that trend because of the smaller margin that you have. You're relying on that trend to predict when you need to do the next inspection or whether you can run at all.

MR. TAMBURRO: Yes, sir. And we've learned from that. Our new criteria requirements are very clear and have eliminated what we think are the potential causes of the problem in '96.

MEMBER SIEBER: Could you be more specific in telling me what it is you do differently because of that?

MR. TAMBURRO: Well, what we do differently at this point is we require that the probe be put in one orientation. Prior to that, there was no requirement. And the inspector could have literally rotated the probe, which would have given us different readings.

We also instruct the operator to clean off the grease and ensure that the surface condition of that monitored location is free of the grease. We also require the --

MEMBER SIEBER: You need the grease in there as a coupling?

MR. TAMBURRO: No, sir. No. The grease is put on there between inspections to inspect the surface from corrosion. We removed the grease and then used a coupling as part of the UT process.

MEMBER SIEBER: But that is also a great type --

MR. TAMBURRO: It's more of a water lubricant. It does have some viscous properties to it, but it's not as thick as the grease we use to protect it on the surface.

MEMBER SHACK: You are protecting the surface because you haven't put the approximate coating on the --

MR. TAMBURRO: Yes, sir. It's bare metal, and it's on the inside.

MR. GALLAGHER: On the inside.

MR. TAMBURRO: And we want to protect the surface.

MR. GALLAGHER: Now, one thing on this that I want to point out, the staff also had a concern along your lines, Mr. Sieber, on this. And one of our commitments that we have committed to is if we take the data and the 19 grids and they are outside of our expectations, we notify the NRC within 48 hours and then enter into our corrective action system.

CHAIRMAN MAYNARD: That's what I was going to -- I'm assuming that under your current program you do take a look at your data compared to what you had and look for anomalies before you just move on?

MR. GALLAGHER: That's correct.

MEMBER SIEBER: Does that cause you to quarantine the inspection area until the NRC has an opportunity to look at what it is you're doing or do you just move on, close up shop, and send a notice in

--

MR. POLASKI: You've got to remember that these locations are inside the drywell. So you'll take these during an outage.

MEMBER SIEBER: Right.

MR. POLASKI: And we have a requirement if we find an anomaly or some problem with them to notify the NRC within 48 hours for corrective action. We need to get dialogue with the NRC and fulfill the corrective action process, investigate the --

MEMBER SIEBER: And right now there is no quarantine requirement?

MR. GALLAGHER: Well, we would do an investigation as part of our corrective actin. So those types of things would be done to make sure we understand the issue and can take additional information or whatever.

But the key point was we would notify the NRC. And we would go through our corrective action process. And we would finish that before we come up from that outage.

MEMBER SIEBER: Let me ask a couple of other detailed questions. Do you use the same instrument each time, -- probably not -- transducer?

MR. TAMBURRO: No, we do not. We use

qualified instrumentation to our procedures. We calibrate them to cow blocks what are appropriate for the thickness.

MR. GALLAGHER: Are you talking --

MEMBER SIEBER: The reason for my question is the footprint of the transducer is usually a rectangle. And you're trying to measure something that's spherical. And so you have a gap between the top of the transducer and the material that you're measuring due to the fact that you have a flat surface against a spherical surface. And the footprint determines how big that gap is.

And so I think you can calibrate that to see both the inside wall and the outside wall. Is that the way that it is done or can an error be made where you are actually looking at the surface of the transducer and the outside wall?

MR. TAMBURRO: The current technology we're using measures the second bounce in the steel.

MEMBER SIEBER: Okay.

MR. TAMBURRO: And it eliminates any gaps between the probe.

MEMBER SIEBER: Okay. So you're going from the far wall back and taking both pulses?

MR. TAMBURRO: We're going from the far

wall back, back to the far wall, and measuring that reflection.

MEMBER SIEBER: Okay. And that appears on the scope?

MR. TAMBURRO: Yes, sir. And our ND technician can give you more details.

MR. McALLISTER: Good morning. Marty McAllister with AmerGen. The two different techniques, one that is used on the outside surface, where it's coated, is the echo-to-echo technique that Pete described, where we're actually timing the second round trip to measure the thickness.

For the readings that are taken on the inside, that's the traditional technique, no echo-to-echo, no curvature effects. Does that answer your question?

MEMBER SIEBER: Yes.

VICE-CHAIRMAN WALLIS: You have also got some indication of the condition of the coating, don't you? It echoes from the coating into --

MR. McALLISTER: If we are able to punch the ultrasound through the coating, then yes, the coating is tightly adhered from the exterior.

VICE-CHAIRMAN WALLIS: But you don't measure anything.

MEMBER SIEBER: You can --

CHAIRMAN MAYNARD: Jack, you need to get to a microphone.

MEMBER SIEBER: You can differentiate between the coating and material.

MR. McALLISTER: That's correct. If we did a traditional technique from the exterior, it would include that coating thickness.

MEMBER SIEBER: Right.

MR. TAMBURRO: Okay. Continuing on, in 2006, we repeated the -- excuse me. The 19 inspections in '94 and '96 also became the basis for an NRC SER that concluded that your key inspections were no longer required and the coating inspections were sufficient.

In 2006, we again repeated the inspections of the 19 grids. The data was consistent with the '94-'92 data and leads to the conclusion that the corrosion has been arrested. When you --

VICE-CHAIRMAN WALLIS: I would think you would want to do some UT measurements anyway --

MR. TAMBURRO: And we did in 2006.

VICE-CHAIRMAN WALLIS: -- or just say, "We'll never do any again."

MR. TAMBURRO: No, sir.

VICE-CHAIRMAN WALLIS: Just defense-in-depth. And every two years, you do some UT measurements.

MR. TAMBURRO: And in 2006, we did. Moving on to slide 74, I would like to go over the methodology in which we do these 19 inspections. Each of the inspections are marked on the inside of the drywell with a permanent marker.

We use a stainless steel grid, which has mark slits on the grid, which line up with the permanent marker on the drywell. We did insert a UT probe through these holes. The diameter of these holes is such that the probe fits snugly inside the holes.

We take 49 readings at the critical locations. Again, the probe is placed through the holes. This is how we can ensure that we get to the same location every inspection.

VICE-CHAIRMAN WALLIS: Is this where the coverage I think comes in? I mean, that's a flat play on a round --

MR. TAMBURRO: If you'll notice, this has a little bit of a curve to it.

VICE-CHAIRMAN WALLIS: I would think so. I would think so, yes.

MR. TAMBURRO: The protective grease is removed. We do our inspections, and then we reapply the protective grease.

Slide 75 is a little schematic of this grid. The data is then collected. We calculate the mean of the data, the standard error of the mean. And we look at the thinnest points.

VICE-CHAIRMAN WALLIS: Does it vary much over this small area?

MR. TAMBURRO: Yes, it does.

VICE-CHAIRMAN WALLIS: It does?

MR. TAMBURRO: Yes. And, as you have seen in the pictures, the back side is very rough.

MEMBER SIEBER: Yes. It looked pretty lumpy.

MR. TAMBURRO: On to slide 76. And that leads into my next slide. There is a fair amount of uncertainty on the means and variance. And that's due to the roughness.

If you go from one point to another, you will see a fair amount of variation. That's why you see some fairly large standard errors on these means. That's the major contributor to the large standard errors.

On to slide 77. The data, the means, and the finished points of each grid are trended over time. So this --

MEMBER ARMIJO: I guess I wouldn't call those errors. I think that's just variability.

MR. TAMBURRO: Variability, yes, sir.

MEMBER ARMIJO: In what you measure it?

MR. TAMBURRO: It's not experimental error.

MEMBER ARMIJO: That same transducer on a flat place, measure it over and over again. You would get much

MR. TAMBURRO: Yes, sir. I'm not much of a statistician. So I have been confusing error with variance.

MEMBER ARMIJO: Okay.

VICE-CHAIRMAN WALLIS: It's surprising that a mean could increase with time.

MR. TAMBURRO: The mean within that standard error --

VICE-CHAIRMAN WALLIS: That's not mood. That's --

MR. TAMBURRO: Within that variance. Excuse me. You see fluctuations in the readings. It's not a physical characteristic that the steel grows. It's just that the numbers will change over time within a variance.

MEMBER ARMIJO: That variance, the experimental variance, is very small compared to the variability of the material you are measuring.

MR. TAMBURRO: Due to the roughness on the back side.

MEMBER ARMIJO: Yes, right.

MR. POLASKI: And just to maybe explain a little bit more, if you had shown me this and some data and you hold this up and you're a technician, you're in there, you put this in exactly the same place, well, it's visually lined up.

If you walk just a little bit, 1/32 of an inch, each of these readings will be different because it's so rough on the other side. That's why you get this difference in the mean because if you shifted one way, some of them go up, some go down. It can affect the average a little bit. It could be one way. It could be the other.

MR. TAMBURRO: And then each point is different.

VICE-CHAIRMAN WALLIS: What does an ultrasonic measurement mean if there is a roughness which is grainier than the size of the instrument?

MR. TAMBURRO: What we do is then we take

49 points and analyze it for --

VICE-CHAIRMAN WALLIS: Don't you get a fuzzy reflection or something or what do you get when you have a waviness which is finer than the size of the instrument?

MR. TAMBURRO: I'm going to ask Marty McAllister to answer the question.

MR. McALLISTER: Marty McAllister with AmerGen. Yes. You will get less of a reflection back from a rough surface. The machines that we use, the data loggers, they're designed to trip at a certain gate level, certain amount of sound that is being echoed back.

VICE-CHAIRMAN WALLIS: Does it tend to reflect from the troughs or the peaks if you get a wiggly surface?

MR. McALLISTER: It will trip off the thinnest.

MEMBER SIEBER: It's a visual, right?

MR. McALLISTER: That's correct.

VICE-CHAIRMAN WALLIS: It's surprising if you have done all of this prep and you have cleaned it and you almost -- you didn't grind it, but you --

MEMBER ARMIJO: The diameter of the signal that is going out, you could pick the size of your probe, right? So you can have a very tiny little signal going to the sound.

MR. McALLISTER: The probes are a pulse echo. Half the probe is sending sound. The other half is receiving it. They're kind of focused so it will create more of a line of sound.

VICE-CHAIRMAN WALLIS: What's the diameter of the signal? What's the diameter of the measuring beam?

MR. McALLISTER: It would be a line that would be the width of the transducer.

VICE-CHAIRMAN WALLIS: Which is?

MR. TAMBURRO: At the hole size.

VICE-CHAIRMAN WALLIS: Hole size.

MR. GALLAGHER: And, Dr. Wallis, I think you got confused on the exterior and interior.

VICE-CHAIRMAN WALLIS: The exterior is rough, right?

MR. GALLAGHER: We talked about the --

VICE-CHAIRMAN WALLIS: You're measuring from the inside?

MR. GALLAGHER: On the inside. When we talked about the dish where we prepared the surface, that's on the outside. And I hope to get to --

VICE-CHAIRMAN WALLIS: That's right.

MEMBER ARMIJO: But literally from this data, you could in principle drop contour maps of what that surface looks like.

MR. GALLAGHER: That's correct, yes.

MEMBER ARMIJO: But you haven't needed to do that or found trying to do that?

MR. TAMBURRO: No. We have data. We have all 49 points.

VICE-CHAIRMAN WALLIS: Have you shown us some of these grids of 49 points?

MR. GALLAGHER: In the calculations that we submitted --

VICE-CHAIRMAN WALLIS: We seem to presume, but there isn't that much variability from one point to the next over such a short distance or is there?

PARTICIPANT: I think there would be.

MR. TAMBURRO: There is a variability.

PARTICIPANT: We have a table.

VICE-CHAIRMAN WALLIS: You have a table?

PARTICIPANT: Yes.

VICE-CHAIRMAN WALLIS: From one point to the next, just that short distance?

MR. TAMBURRO: Yes, sir.

MR. POLASKI: It's one inch.

VICE-CHAIRMAN WALLIS: One inch? It

doesn't vary by half an inch thickness. It varies by --

MEMBER ARMIJO: It's small numbers.

VICE-CHAIRMAN WALLIS: Mls. It varies by mls.

MR. TAMBURRO: Okay. So moving on to slide 77, we trend the data, both the means and the thinness, over time. And the 77 is a schematic of what this -- a representation. The thickness is the *y*-axis. And the time is the *x*-axis.

On 78, we then take that data. And we develop a curve fit of that trend. That curve fit is based on least squares fit.

VICE-CHAIRMAN WALLIS: But since the corrosion has been arrested in your view, there shouldn't be any. It should just be flat.

MR. TAMBURRO: Yes, sir. And it is flat. And I'll get into how we look at that in about four slides.

VICE-CHAIRMAN WALLIS: Okay.

MR. TAMBURRO: We then test the curve fit to the data and determine if it meets the curve with 95 percent confidence. If it does meet the curve with 95 percent confidence, then we use the curve for projection. The next slide shows how we do that projection.

VICE-CHAIRMAN WALLIS: Does it usually meet the curve with that confidence, then?

MR. TAMBURRO: Prior to --

MEMBER POWERS: Can you go back to the previous slide?

MR. TAMBURRO: Yes, sir. Could you repeat the question, please?

MEMBER POWERS: I haven't asked it yet.

MR. TAMBURRO: Okay.

(Laughter.)

MEMBER POWERS: You are looking for a curve with zero slope, is what you're looking for?

MR. TAMBURRO: No. At this point I'm looking for a curve with a slope.

MEMBER POWERS: Are you doing an --

CHAIRMAN MAYNARD: Dr. Powers, could you get closer to the microphone?

MEMBER POWERS: You are doing an F test, which is a test of variance?

MR. TAMBURRO: A test of variance to occur with a slope. Yes, sir. At this point we're looking for a slope.

MEMBER POWERS: I'm just not sure. You've got to look at the ratio of the two variances. And I don't know what the second variance is.

MR. TAMBURRO: The two variances we are looking at are the ratio between the sum of the squared error and the sum of the residual errors.

MEMBER POWERS: Okay. So you're just looking at your inherent error versus your systematic error?

MR. TAMBURRO: Yes, sir.

MEMBER POWERS: Okay.

MR. TAMBURRO: Again, if that curve fits meets the data with 95 percent confidence, then we will perform a projection using that curve fit.

Slide 79 provides a schematic of how we do that. We calculate a lower 95 percent confidence interval on that curve fit; again, if that curve fit has satisfied a 95 percent confidence F test.

This schematic shows also the upper confidence level, but we don't use that. The intercept between the lower 95 percent confidence intervals and 2029 is how we project our margin.

VICE-CHAIRMAN WALLIS: The upper 95 percent confidence looks nonphysical somehow.

MR. TAMBURRO: Yes, sir. Yes, sir.

MEMBER POWERS: So the statistics isn't inherent here. Why 95 percent?

MR. TAMBURRO: Ninety-five percent is what we typically have used with analysis and has been generally accepted by the regulation.

MEMBER POWERS: Why does he accept 95 percent?

MR. TAMBURRO: I can't answer the question.

MR. GALLAGHER: It is reasonable assurance.

MR. TAMBURRO: It is a high confidence level. I am sure on the upper drywell if we used 99 --

MEMBER POWERS: There are multiple ways of looking at it. You can say, "If I did this 20 times, one out of those 20 times, you would violate this," in which case you are dead meat, right?

MR. TAMBURRO: We've done sensitivity studies. We have done --

MR. GALLAGHER: In this one area.

MR. TAMBURRO: We've done sensitivity studies on the upper drywell and have used 99 percent confidence. We still meet margin. We still meet 2029 with margin.

CHAIRMAN MAYNARD: That might be a better question to ask the staff when they're giving their presentation this afternoon, too.

MEMBER SHACK: There is no answer to that question.

(Laughter.)

CHAIRMAN MAYNARD: I am just trying to move us along, Dana.

MR. TAMBURRO: So why did you ask it of me?

(Laughter.)

MEMBER POWERS: Because I ask the staff and I never get an answer. I thought maybe there was some hope.

PARTICIPANT: What if you didn't meet your F test?

MR. TAMBURRO: The next set of slides goes into that.

MEMBER ARMIJO: Well, if you don't meet the F test, that means that physically something is changing and the data shouldn't be correlated with a straight line.

MR. TAMBURRO: If I don't meet the F test, I don't have high confidence that there is a straight curve with a slope. This method worked well for the sand bed prior to 1992.

We had rates between 10 and 20 mls per

year. It only took us 4 or 5 inspections to come up with F tests that met 95 percent confidence. And we did these projections.

It's also working in the upper regions, where we have more than ten inspections over more than ten years. And now we're in certain areas. We're finding areas that are meeting the F test with 95 percent confidence. And we're finding rates of less than that.

However, using the 2006 data for the sand bed and moving on to slide 80, we only have four data sets. And with very high variance, the data did not meet the F test 95 percent confidence. So we had to do more conservative analysis and simulation to show that we would have seen high rates.

And I'm going to move on to slide 81.

MEMBER POWERS: Do you see evidence of pitting in your -- corrosion at all?

MR. TAMBURRO: I'm sorry. I didn't hear the question.

MEMBER POWERS: Do you see evidence of pitting corrosion?

MR. TAMBURRO: We don't see evidence of pitting. We do see evidence of local areas progressing further than other areas, but those would not be characterized as pits. They would just be characterized as areas that have progressed further.

CHAIRMAN MAYNARD: I do want to keep us moving along here. I don't know how much more time that you need, but I don't want to cut off the people for their time this afternoon, too.

MR. TAMBURRO: I'll try and hurry it up. So let's move on to slide 82. We performed simulations based on Monte Carlo-type simulations. And the simulations were intended to answer the question, what's the minimum rate I would have observed with 95 percent confidence given that I only had 4 inspections and I had variances between 8 and 16 mils? This is not a rate we saw, but it is a rate we should have seen given the number of inspections and how much variance is.

Slide 83 provides a schematic of how the random number generator was used. It took a mean, a standard error, and 49. We got out of the random number generator an array of 49 values, which is normally distributed, with a mean and a standard error, not necessarily the same as what was input because of the random generator nature of --

MEMBER POWERS: How do you know your generator was not correlated?

MR. TAMBURRO: I don't know. We used the standard random number generator from a standard product.

MEMBER POWERS: Mr. Gnu's book on semi-numerical algorithms goes at great lengths to decry the use of standard numerical number generators. He will regale you with stories of how correlated they are.

MR. TAMBURRO: Thank you.

Moving on to slide 84, we then did -- this slide is busy. I'm going to walk through it slowly. We then simulated a series of inspections. So item 1 we simulated for our worst location, which was location 19A. We input a value of 800 mls, which was the reading in 1992. We inputted standard error. And the generator gave us a 49-point array, which we then calculated the mean and standard error. This is a simulator standard error.

In 1994, for 1994, we inputted a value 2 mls less. In this case, we simulated a rate of one ml per year, so two years differential, one ml a year, two mls less.

For 1996, we did the same thing. And for 2006, again, we lowered the input mean by the appropriate value for a one-year period, one ml PRA.

With this simulation, we then performed a curve fit. And then we performed the F test on this value. If the F test was successful, we counted it successful. We repeated this 100 times and counted the number of successful tests.

On to the next slide. We then increased the rates. So this slide is a schematic that shows how we progressed at greater rates and the number of times the F test was successful.

For example, for 2 mls per year, we passed the F test 27 out of 100 times. At 8 mls per year, we passed the F test 98 out of 100 times. We refined the analysis. And at 6.9 mls per year, we passed the F test 96.2 times. We did it ten times just to be sure.

VICE-CHAIRMAN WALLIS: This is a very conservative --

MR. TAMBURRO: Yes, sir. Yes, sir.

MEMBER ARMIJO: I don't believe it, frankly, because it doesn't correlate at all with your data.

MR. TAMBURRO: No, it doesn't.

MEMBER ARMIJO: And maybe it's telling me that if it had been as much as 6 mls per year corrosion rate, you would have had 96 percent confidence of finding it, but you didn't.

MR. TAMBURRO: That's exactly the point, sir.

MR. GALLAGHER: And one point we are trying to make with this is that when you take a look at the data, it's flat-lined. It's flat-lined. And we're just using this to show that our inspection frequencies are conservative.

So given this projection, people fast forward given this projection. You know, it goes out ten years. We're inspecting again in four years. So we have a conservative inspection.

MR. TAMBURRO: Mike, you stole my next slide.

MR. GALLAGHER: Sorry, sir.

MR. TAMBURRO: So that's what the next slide says. 6.9 mls per year is the minimum rate we did not observe. We should have observed it with high confidence. So our next inspection is going to be prior to when we project that rate into the future.

For the most limiting locations, 19A and 17D, if we did have a rate of 6.9 mls per year, which we don't, we would reach our minimum value by 2016.

VICE-CHAIRMAN WALLIS: But you are assuming that there is no change in the physical situation in that period of time, that you can just extrapolate past experience. And caution would indicate that you ought to do something sooner because something may have happened. Epoxy may have changed in some way unpredicted and so on.

MR. TAMBURRO: Yes, sir. And moving on to the next slide --

VICE-CHAIRMAN WALLIS: This is like predicting the weather in New England 20 years from now or something.

MR. TAMBURRO: And moving on to the next slide --

MEMBER POWERS: It would be just as bad 20 years from now as it is today.

CHAIRMAN MAYNARD: Let's move on. Next slide.

MR. TAMBURRO: Even though the analysis shows 2016, we will inspect in 2010. So that is much sooner than this conservative analysis tells us we should inspect. And further inspections, we'll use the same methodology to establish required inspection frequencies.

MR. POLASKI: So that completes Pete's presentation. Are there any further questions on that?

(No response.)

MR. GALLAGHER: Yes. Dr. Maynard, what we have next is about the 2006 actual data. So we can continue or --

CHAIRMAN MAYNARD: I would like to go ahead and continue just for a little while here. If it runs too long, we may have to stop, but I would like to get finished with your presentation before we break for lunch.

MR. GALLAGHER: Okay.

PARTICIPANT: The entire thing?

CHAIRMAN MAYNARD: Yes, the licensee's presentation.

VICE-CHAIRMAN WALLIS: The whole thing?

MR. POLASKI: It won't take us long to go through the rest of this presentation on the sand bed region. So Mr. Howie Ray is now going to make a presentation on the results of the October 2006 refueling outage.

Mr. Ray is a design manager, has been a design manager, at Oyster Creek for the last two years and will --

CHAIRMAN MAYNARD: I'm sorry. I didn't mean to complete your entire presentation but the section that we're in right now.

MR. POLASKI: Yes. We're going to do the

sand bed region now.

CHAIRMAN MAYNARD: Sorry.

MR. POLASKI: Thank you.

MR. RAY: Thank you, Fred.

My name is Howie Ray. I'm going to give you the scope of the 2006 inspection that was performed in the sand bed region. We did visual inspection of the coating in all ten bays. That's external to the drywell.

We did UT measurements in 19 grids at elevation 11-foot, 3. That's internal to the drywell. And we did UT measurements of the 106 locally thin single point locations external in the sand bed region.

The results of the visual inspection of the external shell showed no degradation. This was performed by qualified NDE personnel. And these were all satisfactory.

Going on to the next slide, this shows you pictures of the drywell shell. This is 2006 pictures. You saw earlier the 1992 pictures. You can see the OD surface of the shell is still in good condition. Just to point out --

VICE-CHAIRMAN WALLIS: What are those stalic types at the bottom there that stick out from the coating?

MR. RAY: I'm sorry? Could you repeat?

VICE-CHAIRMAN WALLIS: What are those spiky things that stick out from the coating? What are they? Does that have something to do with how the coating was applied? That thing there, yes. What's that?

PARTICIPANT: That's a good point.

MR. RAY: That's just the caulk. That's a caulk between the shell and the --

VICE-CHAIRMAN WALLIS: That's the caulk?

MR. RAY: Yes, probably just --

MEMBER SIEBER: There's another one where the --

CHAIRMAN MAYNARD: Jack? Jack?

MEMBER SIEBER: There's another one where the external UT inspection circle is to the left, right above it.

MR. RAY: These surfaces were visually inspected by qualified, and they were satisfactory. So some of these pictures are deceiving.

VICE-CHAIRMAN WALLIS: There's some color. You have some color in --

MR. RAY: Yes. The other thing I wanted to point out, too, is on the floor. That's a concrete floor there on the left-hand side. Fred, do you want to point that out, where the orange color is? I just want to point out that the shell and the caulking there were satisfactory. That is no indication of any corrosion off of the shell.

MEMBER ABDEL-KHALIK: What is the cause of the discoloration on the floor?

MR. RAY: If you recall the covers to the rebar, right on this side is the biological concrete wall. And there's a possibility of just some of that discoloration coming off the surface rust on that cover. But these were, there was no unsatisfactory condition.

VICE-CHAIRMAN WALLIS: So those yellow patches mean nothing or they're an illusion or something?

MR. RAY: I think they're just shadows in the --

VICE-CHAIRMAN WALLIS: Yes?

MR. RAY: Going on to the next slide, if there are no other questions on that one, this is another picture. We have talked about this one. So I won't spend too much time. But I did just want to point out that the transition, it's obvious where the top elevation of sand was prior to being removed.

Going on to the next slide, I wanted to give you a picture of the bay 19 caulking conditions. This is the bay with our minimum margin at this point just to show you that the shell, caulking, and floor are all in good condition.

MEMBER ARMIJO: Just for a scale, what is the width of that caulking thing? Is that an inch or two or --

MR. TAMBURRO: This is Pete Tamburro. It's approximately an inch.

MEMBER ARMIJO: It gives you an idea of the granularity.

MR. RAY: Okay. The UT measurements at the 19 internal grid locations were completed. And no ongoing corrosion was identified, as Peter just went through and described how we looked at those.

This next slide, this shows a table of the UT measurements of the 19 grid locations that we have taken since 1992. Just to highlight the yellow cells, these are the minimum readings that have been taken throughout the years. And these are the values used to develop the margins for each bay. If you look on bay 19A, you can see 62 mls there is our lowest margin at this point.

The next slide shows a simplified

tabulation of all the bays with their minimum margins. And you could see bay 19 minimum with bay 3 having a maximum of 439 mls.

The next slide, this is a trend graph. We do have graphs of all of the 19 grid locations that are in your reference book. We have included the lowest margin and one of the more significant margins, then, for your review.

Some keys to point out here are the top horizontal line shows the original plate thickness of 1,154 mls. The bottom horizontal line shows the minimum required shell thickness of 736. And the line in between there you can see that has a slope, it's a 15 mls per year slope there on the left up to 1992. That shows the significant corrosion that existed before the sand was removed.

Also, just to note there that we're showing the standard errors there, the 8.4 mls, the 9.9. And those are not corrosion rates. They're standard deviations.

And then you can see from 1992, when we removed the sand, it's fairly obvious that we did correct the situation in that area.

And I just wanted to point out another point of reference on here is between 1994 and 1996, those were two outages where we did not install these triple coating. And you can see it did not have any adverse effect on the --

VICE-CHAIRMAN WALLIS: I'm surprised with all these readings going down so rapidly that you didn't do something before 1991-92. It's past history, but it just seems strange that headed for disaster in '94 --

MR. TAMBURRO: I think the answer would be there was a lot being done. It was just very difficult to get in there to the sand.

MR. POLASKI: There were things being done. I mean, the drain lines were cleared to drain water out. That wasn't successful. They then installed a cathodic protection on two bays. And that didn't solve the problem. And ultimately they decided in 1992 --

PARTICIPANT: Get the sand out.

MR. POLASKI: -- they had to take the sand out.

MR. RAY: Just quickly to show you we did bay 1D in there also, which has 365 mls of margin. Okay. So the 2006 UT readings, let's see. There were 106 individual UT measurements taken externally to the sand bed region.

It was verified that all 106 measurements continue to meet the local thickness requirements. That's both buckling and membrane stresses.

The 2006 measurements that were taken external to the drywell, we've determined they are not directly comparable to the 1992. We have talked a little bit about it before with the difference in technique that we have encountered there.

The next slide, we'll just go through and highlight what the differences were from the UT technique that we used in 1992 and that they were using in 2006.

So in 1992, we did the readings on uncoated surface. The surface had to be prepped enough to get the transducer in there. It's obviously a cupped surface. And traditional pulse, the echo technique was used for that technique.

Today's technique, we are using the echo technique. It does take the readings through the coating. And it also allows the --

VICE-CHAIRMAN WALLIS: The cup thing could also make this cup --

MR. RAY: -- between the transducer and the --

VICE-CHAIRMAN WALLIS: When you make a

cup, the way we have been through this before, you are actually making it a little bit thinner where you put the transducer than it really is or than it was before.

MR. RAY: That's absolutely right. You would expect to have a little bit less just based on that factor.

VICE-CHAIRMAN WALLIS: How big is that? How much stuff do you take out to make that --

MR. RAY: Actually, we have demonstrations if you're really interested in this stuff, but I think it was about 20 mls, Marty?

VICE-CHAIRMAN WALLIS: It's 20 mls. Okay. So it's significant compared with the 60 mls you're talking about for the margin.

MEMBER SIEBER: Well, you usually take it down to where the lowest bid is.

MR. O'ROURKE: I don't think we're saying we took off 20 mls. I think the variability between the readings for 2000 to 2006 was 20 mls.

MR. RAY: Right. Yes. That's what we're saying. So that way --

CHAIRMAN MAYNARD: Keep it down to the point where you've got it smooth enough to do that --

MR. GALLAGHER: That's right.

MR. RAY: So we did have to remove some margin when we did that. And that's why we wanted to minimize it as much as possible.

MR. GALLAGHER: I guess the point was, Howie, from Dr. Wallis' question, --

MR. RAY: I'm sorry.

MR. GALLAGHER: -- we took it down to the lowest point. I mean, presumably we didn't go lower.

VICE-CHAIRMAN WALLIS: You might have done, yes.

MR. GALLAGHER: But we tried not to.

VICE-CHAIRMAN WALLIS: Lower than the average, certainly, yes.

MEMBER SIEBER: You actually can't help it a little bit lower, but it's on the older of a couple of mls.

MR. POLASKI: When we show you results, things are not points that are showing that they're the lead areas or the cleanest areas.

MR. RAY: Because of those differences, we're going to treat the 2006. We used a much more rigorous approach in going and doing these and identifying the exact locations. So we're going to -- these 2006s are baseline going forward. We will be going back in 2008 and remeasuring these.

The next slide, this gives the external 108 points inspection results. The key thing here, this basically shows that there's very few points that are less than the 736 criteria. In bay 13, the lowest reading we have now is the 602 mls. And that still satisfies the required local thickness of 536 mls.

The difference here between the 1992 total and the 2006 total, we could not go back and duplicate the 125 points. Some of the points they took in 1992 were the same in the areas that were cupped. And we just went and got the finished reading, each one of those cups. So we will be using 106 to clearly identify as we should in the pictures, and we have a good baseline to move forward.

Okay. This next picture, we did talk about this a little bit before. But this schedule illustrates all of the 19 grid internal UT readings along with 106 external finished points that we took in 2006. And we also have included the trench UT readings, which adds up to kind of the numbers -- and this also illustrates that right above the 11-foot-3 line, you can see that that is where most of our grids are and that is where we are seeing the thinnest readings. And that is where the points were picked. The majority of the points that were thinnest were picked in that area. So that helps demonstrate that the 11-foot-3 elevation.

This sketch demonstrates the very few measurements fall below the general required thickness of 736 mls. We have yellow indicated there for between 636 to 736 mls. We have one red spot there in bay 13, which is the 602 mls that we measured. And 1992 was the thinnest reading of 618.

I guess an important point was in 1992, they did do a full detailed round with micrometers to make sure that that was, in fact, the thinnest area in that area. They did a six-inch square.

PARTICIPANT: Characterization.

VICE-CHAIRMAN WALLIS: So there are quite a few yellow regions. On the right there, there's --

MR. RAY: Right. These are in the -- we wanted to show you how many different points there were. They're actually all in the six-by-six grids there.

VICE-CHAIRMAN WALLIS: So the other ones are actually mixed in with green ones --

MR. RAY: That's correct.

VICE-CHAIRMAN WALLIS: -- in the same region.

MR. RAY: That's correct. They go into

that calculation.

MR. POLASKI: One thing, just to be clear, the triangles are the single points that were taken from the outside.

VICE-CHAIRMAN WALLIS: Right.

MR. POLASKI: The rectangles, the square boxes were the grids that were taken from the inside. And it's in a particular grid. And I'll point this one in bay 17. There were local points in the 49 that were less than 736. We showed them as yellow just so you can --

VICE-CHAIRMAN WALLIS: It's one-seventh of them, yes.

MR. POLASKI: Any small squares are part of a larger square or rectangle.

MEMBER SHACK: Why do I have seven points in some of the grids?

MR. POLASKI: I am going to ask Pete to address that.

MR. TAMBURRO: During the characterization in the mid '80s, some of the areas to the left showed that they were nominal. So we did not go and do a further characterization. So those areas with only seven, even today, have thicknesses that are very close to nominal.

MR. RAY: Okay. If there are no more questions with that, we will move on to slide 102.

VICE-CHAIRMAN WALLIS: So let us see. The 7 are the ones which are the smaller green square, and the 49 are the big green rectangle?

MR. POLASKI: That's correct.

MEMBER SHACK: Now, if you're coming down in elevation, basically from the top of the sand bed down towards that seam, is there a trend in the thickness loss in places where you have enough measurements?

MR. TAMBURRO: The trend is that the majority of the loss is in the middle, where you see the grids. The inspections of the external below those grids and even in the trenches show that the loss is not as severe.

MR. POLASKI: And I think the other thing to remember on this picture is that where we show in color. This is where we took measurements. The place that's white was thicker than that. And sometimes people tend to lose that that the white is showing a lot of areas greater than 736.

VICE-CHAIRMAN WALLIS: Isn't corrosion worse, sort of the interface between water and air so that if the sand bed was partially flooded, it would actually be protected by the water at the bottom?

MR. POLASKI: Well, there where the interface is where it's at the worst, but if you see from your pictures, there was corrosion on this whole area.

VICE-CHAIRMAN WALLIS: Yes, but it's worst somewhere partway up. It's not at the bottom.

MR. POLASKI: Yes, yes.

MR. RAY: We will be talking about that later.

MR. POLASKI: Okay.

MR. O'ROURKE: Slide 102. To summarize, we have shown you the ultrasonic measurement data that supports our conclusion that the corrosion on the outside of the drywell shell in the sand bed region has been arrested.

Our direct visual examinations have supported the conclusion that the coating shows no degradation and, therefore, continues to protect the external shell.

And based on the ultrasonic measurement data and trend graphs, we supported the conclusion that sufficient margin exists to the minimum thickness requirements.

Going forward, we have defined an aging

management program that includes visual inspection of the exterior coating in a minimum of three bays every other outage and inspecting all ten bays once every ten years.

VICE-CHAIRMAN WALLIS: Now, why is it restricted to three bays? Is it very difficult to do more?

MR. O'ROURKE: It's just distributing them over the ten-year period?

VICE-CHAIRMAN WALLIS: Yes, but it just seems a little risky to do a few bays and not look at everything.

MR. POLASKI: Dr. Wallis, it is difficult to get into this area. I mean, we showed you those 20-inch-diameter man-ways. Those have shielding --

VICE-CHAIRMAN WALLIS: So you are telling me that we have got a camera, a robot that runs all the way around or something?

MR. POLASKI: No, no.

CHAIRMAN MAYNARD: And I would assume that your program is set up that where if you started seeing degradation, that the frequency would be revisited to see if you need to go into all --

MR. POLASKI: That's correct, yes.

MR. O'ROURKE: We will also be repeating

the ultrasonic measurements at the 19 grid locations at elevation 11-foot-3 in 2010 and then every 10 years thereafter and will be repeating the ultrasonic measurements at the 106 locally thin locations from the exterior in the 2008 outage and then in 2 bays every outage thereafter.

VICE-CHAIRMAN WALLIS: Do you have any measurement of humidity in this region ongoing? Wouldn't it be useful just to have a humidity meter in the sand bed region and see how wet it is?

MR. POLASKI: There have been some. You know, we have been asked that question. One of the concerns is any instrumentation will be exposed to a reasonably high radiation field in there. I mean, this is inside the shield wall around the drywell. We don't expect any instruments that would measured humidity would survive.

But this was an area that once you close it off, you don't get any ventilation flow through here.

VICE-CHAIRMAN WALLIS: That's why I'm surprised it rushed it so much because I calculated you need several hundred thousand cubic feet of air to get the oxygen to make all that rust.

MR. POLASKI: But then once the curb --

PARTICIPANT: I mean, it's a conductor.

CHAIRMAN MAYNARD: We have got several side conversations going on. Let's go ahead and move on here.

MR. POLASKI: That completes our presentation on the sand bed region.

CHAIRMAN MAYNARD: Yes. Before we go into the next section, we're at the point in the agenda for a lunch break. I would like to ask the members if 40 minutes would be enough for lunch. Is that acceptable? That way we won't get too far behind. Okay. We will --

MEMBER BONACA: I have another question. A question I have is more real to the MR scientists. Since the leakage from the refueling liner happened so early in the life of this plant, did you ever consider replacement? Did you ever consider replacing the liner?

MR. RAY: We've done extensive back in 1988 -- when we did put this in our non-conformance system, we did an extensive review of it and determined that because of the welding and -- I'm not getting to your question. You are asking for a direct liner replacement?

MEMBER BONACA: Yes. I mean, clearly a

list from your perspective that the water is for refueling cavity and has been plaguing you. And I'm sure this problem right now ends up being very expensive.

MR. GALLAGHER: The only thing we have investigated was about repairs. We actually attempted some repairs in 1983. And right now we feel that we are adequately controlling the leakage with the metallic tape and the strippable coating and that we can ensure that no water gets in the sand bed region. And so that's what we have done.

CHAIRMAN MAYNARD: Mario, I've got some additional questions on that area, too. I think that when we're finished with our presentation, maybe we'll pursue that just a little bit.

I would like to go ahead and break for lunch now. Licensee will come back up here after lunch. And we'll have a chance for more questions. We'll break for lunch. And we'll come back at ten after, ten after 1:00.

(Whereupon, a luncheon recess was taken at 12:27 p.m.)

CHAIRMAN MAYNARD: Okay. I'd like to go ahead and resume the meeting. So we'll turn it back over to the next agenda item.

MR. POLASKI: Thank you.

Mike Gallagher is going to start off with some information about questions on some of the conditions during the accident analysis.

MR. GALLAGHER: Mr. Chairman, we had to follow up on three questions. I think they came from Dr. Wallis. So do you want me to defer that?

CHAIRMAN MAYNARD: Yes. Why don't we wait until he gets back? He should be back here.

MR. GALLAGHER: Okay. So we'll do that after another break.

CHAIRMAN MAYNARD: Okay.

MR. POLASKI: Okay. Our next section of the presentation is dealing with the imbedded portion of the drywell shell. We'd like to discuss the condition of the imbedded shell. We're talking about the condition of the drywell shell in the sand bed region.

If you'll remember, the sand bed region is the portion of the drywell shell that transitions from the lowest portion of the drywell shell, which is fully imbedded in concrete both on the interior and the exterior. The upper portions of the drywell, which is a free standing pressure vessel. We will discuss the condition of the imbedded section, conditions that exist on the surface of the drywell shell when water intrudes between the steel of the shell and the concrete pour both on the inside and the outside of the drywell during construction, and the results of inspections that were performed in 2006.

When we were here in October of last year, we only discussed potential corrosion on the exterior surface of the imbedded section of the drywell shell. During our refueling outage in October of '04, we discovered water below the concrete floor on the inside of the drywell. This was not expected, and is a condition that was not covered in the Oyster Creek licensure application.

We have supplemented our application to include this environment and have modified our aging management programs accordingly. So today we will be discussing the impact of water on both the interior and the exterior surfaces of the imbedded section of the shell.

And Mr. John O'Rourke will lead our presentation on this topic.

MR. O'ROURKE: Thanks, Fred.

The next part of this presentation focuses on the imbedded shell and will support the following conclusions.

First, corrosion on the imbedded surfaces of the drywell shell, both interior and exterior, is not significant, and we will provide you with a discussion of the environment of imbedded steel in concrete and how it prevents significant corrosion.

Our second conclusion is that based on recent ultrasonic inspections in the trench areas is that if there is ongoing corrosion, it's estimated at less than one mil per year.

And our final conclusion, again, based on the ultrasonic inspections is that the drywell shell meets design requirements with margin through the period of extended operation.

First, let me briefly orient the subcommittee with several physical sketches. This sketch shows the elevation of the interior of the drywell, and in particular, Fred is going to point out several locations on the right and left side at the drywell floor at elevation ten foot, three.

Also, on the left side is the concrete that was removed from Bay 5 to form that trench. The area under the reactor vessel, which we refer to as a sub pile room, and the trough that's inside sub pile room that is 360 degrees around the perimeter of the room and directs any drywell leakage to the sump.

Also of note on the right side where the curve exists, that joint between the concrete curve and the drywell shell, we added a caulk sealant to that during the last outage, and we will discuss that more.

The next sketch that shows the drywell support structure, starting at the bottom, it consists of a ten foot thick concrete mat. On top of that is a concrete pedestal that is over 21 feet thick.

Also of note is the sand bed region and the and the 20 inch manway that provides access to the region, and we have a torus room with an elevation of minus 19 foot, six that goes around the reactor building.

Also of note is a waterproof membrane that was installed when the concrete was placed. You can see that that waterproof membrane goes underneath the concrete mat and up the outside of the concrete surfaces up to a level of plus five foot, zero.

The next Slide 108 is a close-up of the drywell support skirt.

CHAIRMAN MAYNARD: Just a quick question. Your elevations, are those from a reference point or is that from sea level?

MR. O'ROURKE: Sea level.

Slide 108, this is a close-up of the drywell support skirt and the sand bed region and what illustrates one of the five drains that Fred had previously mentioned out of the sand bed region, but it also shows the plate thicknesses and the transition area in the imbedded shell where it transitions from the 1,154 mils to 676 mils.

Slide 109, again, this is a plan view of the drywell showing the trench locations, and I had previously shown you slides of the details of those trenches.

Continuing with the discussion of the imbedded external shell in Slide 110, any corrosion of the drywell exterior imbedded surface occurred because of water leakage into the sand bed region, and corrective actions that had been taken for the sand bed region have arrested corrosion of the drywell exterior imbedded shell, including preventing water leakage from entering the sand bed region and sealing the joint between the drywell shell and the floor of the sand bed region to prevent water from contacting the external shell, as I had noted in a previous slide.

Slide 111. For the interior imbedded shell the water that was identified in the trenches in

Bays 5 and 17 inside the drywell when the foam filling was removed during the 2006 refueling outage was determined to have originated from equipment leakage inside the drywell and not from external sources.

The investigations during the outage into the source of the water indicate that there could have been water below the drywell interior floor for an extended period of time. To get more information regarding the condition of the shell, concrete was removed from the Bay 5 trench to expose an additional six inches of drywell shell that had been imbedded on both sides for ultrasonic thickness measurements in a newly exposed area.

CHAIRMAN MAYNARD: I'm sorry. Can you just -- again, I need to relate exactly where you're looking at now. Maybe I have to go back to the slide here.

MR. O'ROURKE: Okay. Let's go back to Slide 108. First, on the external side, the seal, you see the word "seal." That indicates where we put the caulk seal and we showed the photographs of that seal and the condition of that seal as we inspected it in 2006.

When we go to the interior, if you back up to Slide 106, the curve on the right shows the interface between the concrete inside the drywell and the drywell shell.

CHAIRMAN MAYNARD: It's the trench on the left that got full of water.

MR. O'ROURKE: The trench on the left that got filled with water.

MR. POLASKI: This is the trench at Bay 5, and you'll note that the bottom of that trench corresponds to the bottom of the sand bed region. So when we're talking imbedded region, we're talking from here down, and when we move that additional concrete from this region, the detail doesn't show here. This is the first time we're able to give UT thickness measurements on the drywell shell in a region that had been imbedded both on the inside and the outside.

MR. O'ROURKE: Okay. This is the blow-up that I showed previously of the Bay 5 trench, also showing the additional concrete that we removed. When we took the foam out of this trench, we had about five inches of water in the bottom of the trench. We do have a photograph of that coming up in a later slide.

MR. SHACK: This is an experiment to test the corrosion environment.

MR. O'ROURKE: And back to Slide 112, we did remove the additional six inches to interrogate the area that had been imbedded on both sides sine the original construction, and we will present the ultrasonic measurement data for this inspection as part of this presentation.

The corrective actions implemented during the 2006 refueling outage included caulking the joint between the drywell interior floor and the drywell shell, and I pointed that location out in the elevation view. We also made repairs to the collection trough inside the sub pile room to prevent any leakage into the concrete, both of which I had shown on that previous slide.

Fred.

MR. POLASKI: Thank you, John.

Our next section is going to be a presentation on corrosion of steel imbedded in concrete. Making this part of the presentation will be Mr. Barry Gordon. Mr. Gordon holds Bachelor's and Master's degrees in material science engineering from Carnegie Mellon University. He has been involved with nuclear systems corrosion concerns for over 38 years while working for Powell Laboratories, General Electric Nuclear Energy, and Structural Integrity Associates.

He is a member of the National Association of Corrosion Engineers for 34 years and has served as unit committee chairman of corrosion and nuclear energy systems and group committee chairman of energy technology.

Mr. Gordon is an NACE certified corrosion specialist and a registered professional engineer in corrosion engineering. He has authored or co-authored over 50 corrosion publications, including chairing the 2006 ASM Volume 13(c) section on corrosion in a nuclear power industry.

Also, Mr. Gordon is currently preparing the utility requirements document for materials for advanced light water reactors for EPRI.

Mr. Gordon.

MR. GORDON: thank you very much, Fred.

I'm going to briefly discuss some of the science involved, why carbon steel and concrete environments work so well together. You know, any construction site you'll see lots and lots of rebar and the pouring of concrete onto the steel, bare carbon steel, and why it's a satisfactory structural system.

We've used, you know, tunnels and concrete-like steel pipe, and there's a reason for doing this.

The first slide.

The drywell shell is constructed first, and then on each side the interior and exterior concrete was poured in. When you have wet concrete in contact with steel, the concrete mixture is at very high pH, and this forms a passive film on the surface of the carbon steel, and it's a very resistent film.

And as the concrete hardens, even though it becomes very hard, it still contains pores in the concrete and the concrete contains it's called pour water, and this pour water is, again, very high pH and it mitigates corrosion.

So looking at the slide, again, the concrete. The shell is constructed first, covered both surfaces of the imbedded steel with concrete. The high pH is like 12.5 to 14 during the hydration of the cement, which is one of the mixtures in the composite concrete material. It forms a passive film on the surface which mitigates corrosion, and again, that's why this system is used for constructing buildings, tunnels, swimming pools, whatever.

Going to Slide 116, the reactor cavity water, looking at the exterior environment now. The reactor cavity water, which leaked down, went through sand bed, was certainly affected by the sand bed region, and there may be some concern for that.

But a chemical analysis of this water, again, it's reactor cavity water which is very high purity to begin with, reveals that the pH is greater than seven. The fluoride content was 0.045 parts per million, and the sulfate concentration was 0.32 parts per million. That's very high purity.

And the next line I have there is an average of 3,600 waters, potable waters, natural waters around the United States, and it shows that the typical concentration is much higher, orders of magnitude higher in chloride and orders of magnitude higher in salts.

DR. WALLIS: So why was there so much corrosion on the outside originally?

MR. GORDON: It doesn't take -- in that particular area, in the sand region, there's no concrete there to protect it.

DR. WALLIS: But still why is it aggressive though? It should be neutral.

MR. GORDON: Oh, I mean, pure water will certainly corrode steel, but I'm talking about in the area where it is imbedded in concrete. It's a different environment.

Again, the American Concrete Institute has rules on what kind of water is aggressive to concrete, and the GALL report and the EPRI studies have all supported the same level, and both these levels of the water obtained from the sand bed region is high purity and is not an aging concern.

Continuing with Slide 117, then the water would have been the same high quality as we saw as listed in the previous slide, but it would be interacted with the high pH pour water, concrete pour water, and it would provide a passive film for the carbon steel.

Again, per the GALL report and for the EPRI report, which is listed here, since the pH is greater than 5.5 and the chloride content is way below 500 ppm and the sulfate is below 1,500 ppm, there is not an aging concern for imbedded steel in concrete.

Now let's look at the surprise water that was found during the last inspection on the interior surface and see why that is also not a concern. A chemical analysis was performed on this water, and the next slide will actually show what this water looks like. Again, the pH of this water was 8.4 to 10.2, and this is even after it's exposed to the CO_2 in the air, which would lower the pH. So the pH is probably at least two points higher than this.

High pH, and that's what you want to maintain a passive film on carbon steel.

The chloride content, again, 13.6 to 14.6 ppm. It's way below the limit of 500 ppm.

Sulfate, again, 228 to 230, way below the 1,500.

The calcium content is just presented here as a point of interest, and we'll discuss that in the next slide. There's no GALL or EPRI concern with that.

So this water that you have looked at in the trench five is considered high purity concrete pour water, which mitigates corrosion of carbon steel. Again, this water that was found there complies with the GALL and EPRI and ACI recommendations.

The next slide shows the trench five, the water that was found in trench five, and the calcium content, which I illustrated on the previous slide indicates that the water was there for quite some time. Water leaches out calcium hydroxide first from concrete and it's an indication it took some time to get there and, again, it mitigates corrosion.

Any subsequent water that may be found in the interior of the drywell also will be affected by this concrete pour water, have a high pH, and will be also high puree and will not lead to any degradation of the carbon steel.

MR. ARMIJO: Where did this water come from?

MR. GORDON: This is apparent during a maintenance.

MR. ARMIJO: It was a spill.

MR. GORDON: Yes, spills and things like that.

MR. GALLAGHER: As we mentioned in the beginning, it's equipment leakage. So the design of the drywell and the equipment leakage collection system, and so any leakage would come down, go in the sub pile room, go in a trough, and then goes into the sump. So it's designed that way to collect any leakage. That's where this leakage came from.

MR. ARMIJO: But did this water migrate through the concrete or did it just kind of flow over the top of something and just pour into this hole?

MR. POLASKI: It could have come from two sources. The investigation showed that the trough that we pointed out earlier in the sub pile room that all of the leakage is supposed to flow into and then drain to the sump did have some leakage in it. It was not in the condition it should have been, and that some of that water did migrate through the concrete and showed up in these troughs.

The other thing is John mentioned earlier that we have now installed caulking at the edge of the curve, you know, against the scale of the drywell. Most other BWRs have that caulked. Oyster Creek did not. Oyster Creek is unique. It has a curve there, but if there was any leakage that got on the shell of the drywell and ran down, it could have gotten directly below the concrete. Either of those ways could have accounted for this.

MR. GORDON: And, again, this slide shows the water, and you can see the carbon steel there, the bare carbon steel. This has some superficial corrosion on it.

What happens to the steel that's not protected by the water, basically the side pH water.

MR. SHACK: Did you make inspections or, okay, there is inspections later.

PARTICIPANTS: Yes.

MR. GORDON: What happens to the steel that isn't protected by this high pH, high purity water? When the drywell is inerted, the cathodic reactant for the Trojan (phonetic) reaction oxygen is depleted and corrosion would basically stop at that point.

Any possible subsequent steel corrosion would occur only during the brief outages, which are just a few, you know, ten days per year on average, and you wouldn't expect to see much atmospheric corrosion.

Finally, the transport of any oxygenated water that may come in from equipment manipulation would be affected by the high pH core water and also it would have to displace the oxygen depleted water before you'd see any corrosion.

So basically imbedded steel in concrete is not a concern on either the interior or the exterior of the drywell.

CHAIRMAN MAYNARD: Are you going to provide more justification for the superficial corrosion that you saw there or cover that in the inspection? I mean, you made a statement that there's some superficial rust there. I'd like to have a little bit more to go on than just that. How do you know it's superficial?

MR. GALLAGHER: Yes, Howie, answer that.

MR. RAY: Yes, so that's going to actually lead into the infraction to be performed.

CHAIRMAN MAYNARD: As long as it gets

covered there

MR. POLASKI: We will cover it in a couple of slides.

MR. GALLAGHER: And, Dr. Maynard, basically the bottom line is on the interior when we did UTs in the trench, and so you could easily wipe off the corrosion, and then we UTed the whole trench area and we have that data in here.

MR. POLASKI: So any other questions on --

DR. ABDEL-KHALIK: How much farther do you think beyond the trench that you dug in does the water extend or is the concrete in intimate contact with the steel along this entire bottom surface?

MR. POLASKI: The concrete that's on the inside --

DR. ABDEL-KHALIK: Right.

MR. POLASKI: -- as we said before, the concrete or the drywell shell was welded together and then the concrete was poured on the outside and then on the inside. So it is in intimate contact.

DR. ABDEL-KHALIK: So if it is in intimate contact, why is there water in the top part that you dug out?

MR. POLASKI: Well, even though it's in intimate contact, you can still get water into that.

There isn't really a gap there, but water can get in between, you know, soaked into the concrete along the steel.

MR. GALLAGHER: Yes, the concrete pour water throughout the concrete slab, and you know, so there's water there.

MR. RAY: Yes, the concrete is poured in different sections. So there's actually a pass where the water can get into the concrete or could migrate through the different paths and seek its elevation, to answer your question.

DR. ABDEL-KHALIK: Can you speak up a little bit louder?

MR. RAY: Yes. The concrete was poured in several different layers. So there are --

DR. ABDEL-KHALIK: Horizontal halves?

MR. RAY: Horizontal, yes.

DR. ABDEL-KHALIK: So, I mean, if I look at this picture, how much water is there and how much water don't I see?

MR. POLASKI: We believe based on what we found, when we found this water there was about five inches in the bottom of Trench 5. It was pumped out and then it filled back in again. So it was coming from, you know, underneath the concrete and other areas.

We believe that the whole inside of the drywell below the floor has water in there.

MR. ARMIJO: So you think there's water in this lower part of the sphere --

MR. POLASKI: Yes.

MR. ARMIJO: -- between the concrete and the shell.

MR. POLASKI: Yes, that's correct.

MR. ARMIJO: And the source is the sump.

MR. POLASKI: Well, the source is equipment leakage. It wasn't from the sump itself, but from the troughs that then lead into the sump indicated there was leakage out of that trough. However, there would have been water in the past if there was a leakage in the drywell, and again, there was some small amount of leakage in the drywell; if it got on the drywell shelf, could have run down and gotten directly below. It could have been there for years.

MR. GALLAGHER: Let's be clear. The trough that we're talking about is this trough that goes 360 degrees on the interior of the sub pile room. That's designed to collect the water and then move it to the sump.

There were some defects in this trough so that some water could have got into the concrete. We don't know how far, you know, water is down there. We're assuming it's down there and that we've taken action to have an aging management program, assuming it's there to check, and that's what we've done.

MR. ARMIJO: Well, the water level, you know, if it's in direct contact, if it refills, the water level is coming from somewhere. That's at least that elevation or higher.

MR. GALLAGHER: Yes, and this elevation here is the highest at that point. It's higher than the bottom of the trench was. We've corrected this trough. So we wouldn't expect anymore water to get in there, but we added it to our aging management program to verify that, to verify if there's any ongoing effect.

But this trough elevation, see, right here, if you look at the side, that's the bottom of the trough, and then the bottom of the trench we're talking about is at the bottom of the sand bed floor.

So any water you have coming down here going into the trough, if the trough was not finished correctly, would have gone into the concrete. So we fixed that.

MR. ARMIJO: But it's feasible the whole bottom of that shell could have water in it.

MR. GALLAGHER: And that's what we're presuming. We haven't verified it, you know, because we only excavated down here.

MR. POLASKI: We're assuming there's water there, but Mr. Gordon's presentation is just addressing what would the conditions be, and once that water gets in there --

MR. GALLAGHER: It should be benign.

MR. POLASKI: -- it should be benign. A passive layer was there when the concrete was initially poured.

MR. SHACK: It would be better if it wasn't there.

MR. GALLAGHER: That's correct.

MR. GORDON: But you know, concrete, even if it's very well cured and very old, it still has this moisture in it. It's like a very hard sponge with this concrete pour with a high pH pure water. So it really is basically a hard sponge, and it works very successfully with steel.

DR. ABDEL-KHALIK: But that would not be the source of the water you're seeing. I mean, you pumped it out and the thing filled up again.

MR. RAY: The source of the water was coming through the trough. We paired a void there, and we won't have that source of water.

DR. ABDEL-KHALIK: Okay. If you went and looked at it today, it would be full of water again?

MR. RAY: We would not expect it. It still had a little moisture in the bottom Trench 5 when we started back up. With the operating cycle, we would expect that to evaporate off.

MR. SIEBER: Did you find cracks in the concrete?

MR. RAY: No, we've done structural monitoring, logged into the concrete, and had no significant cracks. The only void we found was in that trough, and we did verify there was leakage through there with a leak test.

MR. POLASKI: Any other questions? Okay.

MR. SHACK: It just seems like 40 years of operation to find a trough has a hole in it.

MR. POLASKI: Yes.

MR. ARMIJO: When the trough was first excavated, was there any data that showed that there was water in the trough when it was first built?

MR. GALLAGHER: The trench?

MR. ARMIJO: The trench, I mean, yeah, the trench. When that was opened up the first time, did people find that full of water?

MR. GALLAGHER: When it was opened up the first time, I don't think there was any water in there, but we did find we did have some information that there was water there at one point, and in subsequent checks it wasn't there. So that's why we thought there was not a water environment in the lower elevation of the drywell, and that's why we hadn't included that as an environment in our LRA.

One thing we did though. We said, well, let's look at these trenches again, and that's when we identify this and put it in our corrective action system to update our LRA.

MR. ARMIJO: Have you ever experienced recirc water pump seal leak?

MR. GALLAGHER: Plant -- Tom Quintenze.

MR. QUINTENZE: I'm Tom Quintenze, AmerGen.

The question, I believe, was have you ever experienced recirc pump seal leaks.

MR. ARMIJO: Yes.

MR. QUINTENZE: And the answer to that is yes.

MR. ARMIJO: Would that be the source of

this water?

MR. QUINTENZE: It could be the source of water. In earlier years we did have some significant leak, but current history indicates that we've maintained our unidentified leak rate, which would be leakage from a recirc pump seal at a very low level, on the order of .1 to .2 gallons per minute.

MR. GALLAGHER: We know that we do have equipment leakage, like control rod drives. There's some leakage from them typically. They're right above the sub pile room, you know, right above this room here, and water drips down in all BWRs, and that's the case.

As Tom mentioned, there is an unidentified leakage criteria, no more than five gallons a minute unidentified leakage in your primary containment, and you know, we meet the technical specification limits by far. But this is designed to collect that leakage, any leakage like that and then take it away to the sump and then pump it out of containment.

MR. ARMIJO: Thank you.

MR. SIEBER: Given enough time though, that's a lot of water.

MR. GALLAGHER: Yes.

MR. POLASKI: All right. We've now heard

about the effect of water on carbon steel imbedded in concrete and how we expect minimal corrosion on the imbedded part of the drywell shell. I'd now like to have Mr. Howie Ray present the results of inspections that were performed during October 2006 refueling outage for the imbedded portion of the drywell shell.

MR. RAY: Thanks, Fred.

During the 2006 refuel outage, visual inspections of the surface of the trenches did show minor corrosion. It was easily removed with no material loss of metal or degradation of the surface, and the visual examinations were done satisfactorily at those surfaces.

And as we just discussed, you know, that superficial effect was what you would expect based on the technical (speaking from an unmiked location).

The UT measurements taken in trenches were used to compare the total corrosion on the inside and outside between 1986 and 2006. It is known that there was significant corrosion that was ongoing in the exterior surface that was not imbedded up to 1992 when the sand was removed.

The material loss identified was consistent with the corrosion rates on the outside of the drywell before the sand was removed in 1992.

So the next slide illustrates the 1986 readings versus the 2006 readings for both Trench 5 and Trench 17. This did not include the additional six inches of surface UTs that we exposed. We'll discuss that later.

What's critical here is there is a difference of 38 mils for both of those trenches, but that we would note that that occurred between the 1986 and 1992 time frame, before the san was removed, and you had significant corrosion going. So that would not be an unexpected corrosion rate.

CHAIRMAN MAYNARD: Okay. How do you know that that occurred over that time frame as opposed to something that has recently started? It's kind of hard to get a rate.

MR. RAY: Well, we're assuming that, but we know we had significant corrosion going on while the sand was there. We've shown that on the graphs with both of them. Bay 17 and Bay 5 both had significant corrosion rates going on.

So if you took that across those years that you had the sand installed with the water, we can assume it. We can't verify that, but you do have still good coating on the outside and you have a technical justification that says that water in this area would not cause significant corrosion inside the drywell.

MR. GALLAGHER: And part of the basis is, when we get to the next slide, when we interrogated the six inches below the concrete floor, the corrosion rate -- Howie, why don't you go into that and you can show him that -- the corrosion rate which is really over the entire period of time since that shell was imbedded in concrete.

MR. ARMIJO: Before you go, did you find water to the same extent in Trench 17 as you did in Trench 5?

MR. RAY: No, we did not. The Trench 17 is about six inches shallower than the trench in Bay 5.

MR. GALLAGHER: So it's a higher elevation. There was a little moisture in there, but --

MR. ARMIJO: If there had been water there, it would have drained to a lower level?

MR. GALLAGHER: Yes.

MR. RAY: It was seeking its elevation. It was voiced in Bay 17, but there's no standing water.

DR. ABDEL-KHALIK: The statement that was made earlier that the water from both the inside and outside surface of the imbedded region is not conducive to corrosion.

MR. POLASKI: That's correct.

DR. ABDEL-KHALIK: And that statement is presumably applicable prior to 1992.

MR. POLASKI: That's correct.

DR. ABDEL-KHALIK: So how can you say that 38 mils of corrosion had occurred between 1986 and 1992? How are these two statements consistent?

MR. POLASKI: Between 1986 and 1992 there was still sand in the sand bed region and there was corrosion ongoing on the exterior of --

MR. RAY: These are not imbedded. This is actually in the -- above the floor.

DR. ABDEL-KHALIK: Yes, I understand, but the statement was made that the leachate from the sand region, the water that came out of that, which presumably is the same as the water on the outside surface of the imbedded region, is not conducive to corrosion.

MR. GALLAGHER: For clarity, let's go to Slide 51, which is the trench cross-section, and so somebody can point with a pointer, but basically what we're saying is you can see the curbs at the top here, the lower curb and the upper curb. So one side is imbedded in concrete, on the interior. On the exterior it is not in the sand bed region. So these measurements that we're talking about here are in the trench, which goes from, say, the sand bed floor, you know, up to, I guess, where the lower curb is So --

DR. ABDEL-KHALIK: So they're in opposite below the sand bed --

MR. GALLAGHER: Not below the sand bed floor, right. So when the exterior side of that -- Fred, point to that -- that's where the sand was. So it corroded on the exterior side of that.

DR. ABDEL-KHALIK: Thank you.

MR. GALLAGHER: And then what we did is go further down there in that six inches right there to get concrete on both sides, to see what it looked like on both sides.

And Howie is going to talk about that next.

MR. RAY: Thank you.

So what we did do in Bay 5, we did excavate an additional six inches of shell surface in the bottom of the trench in Bay 5. That did give us an area that was previously imbedded on both sides, which now would give us some good data that would validate what you're trying to say.

We measure an average thickness of that additional surface. It was 1,113 mils as compared to a nominal of 1,154 mils, which would have been the initial installed thickness in 1966. If you took that time frame, that 41 mils relates to about a mil per year, which is fairly insignificant. It would still be bounded by anything that we have, you know, that we're monitoring above.

There are 106 individual UT measurements made from the exterior of the sand bed region. They are baseline for monitoring corrosion of the interior inbedded surface of the drywell for future outages, and we basically believe that the coating on the exterior shell remains in good condition, and the changes are only expected at wetted surfaces inside the drywell which would occur during refuel outages.

The joint sealant between the sand bed floor and the exterior drywell shell was inspected and found to be in good condition. No water was identified in any of the sand bed regions. All ten bays were inspected.

That's it for the imbedded. Back to John for conclusions.

MR. O'ROURKE: Slide 127.

To summarize our conclusions on the imbedded shell, we discussed the ultrasonic measurement data that demonstrates that corrosion on the imbedded surfaces of the drywell shell, both interior and exterior, is not significant, and we discussed the environment of imbedded steel in concrete and how it prevents significant corrosion.

We also demonstrated that if there is any ongoing corrosion, it is estimated to be less than one mil per year. And at less than one mil per year, the drywell shell meets code thickness requirements with margin through the period of extended operation.

MR. SHACK: You lost 41 mils. When did you make the trench? We estimate there was no water when you cut the trench, right?

MR. POLASKI: It was in 1986.

MR. SHACK: 1986, okay. So --

MR. O'ROURKE: Well, the 41 mils though is the portion that we newly excavated in the 2006 outage that had been previously imbedded on both sides since 1966 when the --

MR. SHACK: I'm trying to figure out how long it was submerged in water though. In 1986 it wasn't. So it's something less than --

MR. POLASKI: Well, in 1986 there was no

standing water found in the sump or in the trench.

MR. O'ROURKE: Slide 128.

Our aging management program going forward includes repeating the ultrasonic measurements in both trenches, including the newly excavated six inches in 2008, and if those results indicate no significant changes, we plan to fill the trenches with concrete and restore the curb to its original configuration, and we will repeat the ultrasonic measurements at the 106 external points in 2008, performing ultrasonic measurements in two bays every refuel outage starting in 2010 with all bays inspected every ten years.

Fred.

MR. POLASKI: Thank you, John.

Any other questions on the imbedded portion of the drawing?

What we'd like to do now --

CHAIRMAN MAYNARD: Excuse me. I think I heard a question over here.

MR. POLASKI: Okay.

DR. ABDEL-KHALIK: If you were to actually restore the curb to the original configuration, you would have no way of knowing whether additional water is seeping in the gap between the bottom and sperical surface of the shell and the concrete.

MR. O'ROURKE: That is correct, but by restoring the concrete to its original configuration, we will re-put that passivating layer back in place. So we will be protected as the rest of the imbedded shell is currently protected.

DR. ABDEL-KHALIK: But you wouldn't know that the state or whether or not there is any water below the surface of where you're at now.

MR. O'ROURKE: That's correct. However, our corrective actions that we implemented during this outage intended to prevent any water from getting into the space between the shell and the concrete, included not only fixing the trough, but also the caulk that I mentioned that was applied to the concrete shell interface on the inside of the drywell to prevent any leakage, potential leakage, down the shell from getting into that area.

MR. SIEBER: And if it did, you would not care, right?

MR. POLASKI: That's correct. If you remember Mr. Gordon's presentation was that that passive layer was formed with the concrete was poured. Any water that would get in there because of being with the concrete would have a high pH, was nonaggressive, wouldn't impact that passive layer, and that passive layer will prevent any further corrosion of the imbedded steel.

MR. ARMIJO: But that water really shouldn't be there.

MR. O'ROURKE: And our current actions are attempting to minimize that water from getting in there.

MR. GALLAGHER: On thing for clarity. You know, it's not that there's no monitoring even when we fill these trenches back up because what we talked about is the 106 points. The reason why we talked about them in this section is because it does provide some monitoring in the area behind the curb. So, again, if you looked at the overall graph, the data that's in your handout, a lot of the individual points are behind the curb, and so we are monitoring, you know, that area.

DR. ABDEL-KHALIK: What is the volume of your sump?

MR. GALLAGHER: The sump volume? Tom, anybody, the volume of the sump?

MR. RAY: I could guess. Do you remember, Tom?

MR. POLASKI: Or do you remember what the physical size of it is?

MR. QUINTENZE: Tom Quintenze, AmerGen.

I would estimate that the volume of the sump is approximately 500 gallons.

DR. ABDEL-KHALIK: So at an unidentified leak rate of five gallons per minute, you can actually fill the sump in 100 minutes, correct?

MR. GALLAGHER: Right.

DR. ABDEL-KHALIK: So it is quite possible that you can fill the sump and you will have water standing on the floor, on the concrete floor.

MR. GALLAGHER: No, the sump is pumped out.

DR. ABDEL-KHALIK: Is pumped out?

MR. GALLAGHER: Yes.

DR. ABDEL-KHALIK: At what --

MR. GALLAGHER: Well, it's an automatic pump.

MR. SIEBER: Now, any time you put drips and drains onto the floor, you're going to find water on the floor. I mean, some people are more careful about how they pipe the drips and drains away, but apparently yours just go to the floor, right?

MR. GALLAGHER: Yeah, the collection system is the floor.

MR. SIEBER: I got it.

MR. POLASKI: Any other questions on the imbedded section?

What we'd like to do now is there were some questions we were asked this morning. We got some answers and new information. So Mike Gallagher has got some information about the conditions for the analysis.

MR. GALLAGHER: Just a couple of final questions. I think, Dr. Wallis, they were mostly from you. The one on the two pound external pressure, yes, physically that's not possible for the refueling condition for the hatches are open. It is an accident condition. The torus reactor building vacuum breakers would limit the pressure inside the containment to less than a negative two pounds, you know. So that's why that two pounds was put in place, to envelope that in the analysis.

DR. WALLIS: Maximum possible.

MR. GALLAGHER: Yes.

DR. WALLIS: Okay.

MR. GALLAGHER: And then the other question was about the elevation 74.6 about flooding up containment. In a DBA analysis, it does not go anywhere near that high. It's really just for severe accident management procedures. You could flood; if you don't have your ECCS and things like that, you could flood up behind the top of the --

DR. WALLIS: But to the vents.

MR. GALLAGHER: -- add the fuel, and then not to --

DR. WALLIS: So it's the maximum possible?

MR. GALLAGHER: It's the maximum possible.

And then the third question you had was about how much rust did we measure, and Pete Tamburro has the answer to that.

MR. TAMBURRO: The answer to that is --

CHAIRMAN MAYNARD: Microphone, please.

MR. TAMBURRO: Thank you.

This is Pete Tamburro speaking.

We did not do a complete 100 percent characterization of the rust. We did go into some of the worst bays and look at a 12 by 12 inch area. The thickness of the corrosion byproduct was an inch and a quarter to an inch and a half in thickness.

DR. WALLIS: Inch and a half of rust?

MR. TAMBURRO: Yes, sir.

And we then did a calculation to determine if that amount of rust was consistent with how much material we had lost. The calculation showed that it was consistent.

We then took that corrosion byproduct and sent it to our labs for further analysis.

DR. WALLIS: So you didn't do an integrated measurement of how many truckloads of rust you took away.

MR. TAMBURRO: No, sir.

DR. WALLIS: No. Okay.

CHAIRMAN MAYNARD: But you know it has got to be a lot.

DR. WALLIS: Yeah.

DR. ABDEL-KHALIK: I have a follow-up question. Is the status of the sump pump or the sump level monitored in the control room?

MR. POLASKI: Yes, it is. There's surveillance tests the operators perform when it's pumped out, and they put it out to measure the leakage and how much water is going into the sump.

CHAIRMAN MAYNARD: Isn't that one of the input to your leak rate calculations?

MR. POLASKI: Well, that is the primary for unidentified leakages, is the pump-out.

DR. ABDEL-KHALIK: Okay. Thank you.

MR. POLASKI: If there are no other questions, we'll now go on to the final part of our presentation on the upper drywell shell. We have presented information so far on both the sand bed and the imbedded regions of the drywell shell and why the drywell shell meets the code required thickness in these areas. The upper region as we define it in this presentation are those elevations of the drywell above the sand bed region.

Extensive ET measurements of the drywell shell thickness have been performed in the upper regions of the drywell shell. Corrosions in the upper regions have been much less than in the sand bed region, and there is more margin to code design thickness requirements.

The UT thickness measurements are taken and analyzed using the same methods as were previously discussed by Mr. Tamburro for the sand bed region. We provided you with information and details from the upper drywell shell in the package that we provided in December. Because much of that information is the same as we have already present, we will be focusing our presentation on the current condition in the upper drywell shell and results of the 2006 refueling outage inspection.

This will be a brief summary so we can answer any questions you may have. Mr. O'Rourke will be making this presentation.

MR. O'ROURKE: Thanks, Fred.

This part of the presentation will discuss the upper drywell area and will support the following conclusions.

First, the areas we are monitoring are the lead indicators of corrosion on the outside of the shell. Recall from Fred's previous discussion if water gets past the seal leakage trough, this is the area of the shell that would be wetted first, and this area does not have an epoxy coating as the sand bed region. It was coated with a red lead primer only, and I will show you the ultrasonic inspection data for this area.

Our next conclusions are that the corrosion of the upper shell is less than one mil per year and upper drywell shell has a minimum of 137 mils of margin, which is 25 percent of the minimum required thickness of 541 mils. And we will discuss the ultrasonic measurement data and trend graphs that support this conclusion, all of which supports the overall conclusion that based on current corrosion rate, we had margin through the period of extended operation.

DR. WALLIS: Now, this leakage by the upper shell is presumably not everywhere. It's just in certain places, isn't it? I get the idea that the rivulets run down rather than the stream that runs down over the whole upper shell when there's a leak. So you'd expect corrosion just in certain places where these rivulets are?

MR. POLASKI: Today we don't expect any leakage to get on --

DR. WALLIS: No, but I just wonder how you sample when you've got this very non-homogeneous corrosion pattern.

MR. GALLAGHER: Yes, and I think John is going to get into that next and who you where our finished locations are.

DR. WALLIS: And down at the bottom where you've got sand to sort of distribute the water, it's different from at the top where you've got streams if any is coming down in certain places.

MR. O'ROURKE: Right, and because of that, starting in 1983 --

CHAIRMAN MAYNARD: Let's take just a moment here.

There went an eardrum, I think. Are you okay now?

All right. Let's try to resume.

MR. O'ROURKE: Thank you.

So starting in 1983 over 1,000 ultrasonic measurements were taken around the circumference of the drywell at three elevations to locate those areas of corrosion on the external surface of the drywell shell.

In addition, a random sampling of additional locations in the upper drywell were measured to insure that the thinnest locations had been identified. Thirteen grid locations have been selected for ongoing monitoring.

DR. WALLIS: Do we have a picture of the pattern of those 1,000 measurements somewhere?

MR. GALLAGHER: In the package of information we sent in on December 8th, there were some drawings in there from the clickable links and so that there was the original drawings that we had that information.

CHAIRMAN MAYNARD: Let's go ahead.

MR. O'ROURKE: Concluding with this slide, these locations are measured every other refueling outage, which is our ongoing aging management program for this area.

The next is planned view of the drywell, and what it does show here are the 13 locations that we monitor every other outage.

MR. GALLAGHER: But I think to get to Dr. Wallis' original question, so you can see we identified where the thinnest occasions were, and yeah, they aren't like randomly -- they're not evenly distributed throughout the drywell.

CHAIRMAN MAYNARD: Based on the original of the thousands that you took before.

MR. GALLAGHER: Go around each area and interrogate it.

DR. ABDEL-KHALIK: Now, this last outage you identified another location at the 71 foot, six inch elevation. Is that going to be added to this collection of locations to be monitored?

MR. POLASKI: The measurements we did at the 71.6 foot were at the transition from the knuckle region to the thin above that. We did it in this outage. We've got the next outage. We're taking readings at four locations around the circumference of the elevation. We did two on this outage, two the next outage, and then four years later we're going to repeat those to determine whether there's any corrosion occurring in those areas or not. It says in the future and beyond will depend on what we find during these two sets of readings.

MR. O'ROURKE: So to summarize what Fred

just said, we're going to take readings in those locations twice, four years apart in the same occasions.

CHAIRMAN MAYNARD: And I take it these are included in your aging management program and your commitments.

MR. O'ROURKE: Yes.

MR. GALLAGHER: Yes, they're commitments.

MR. O'ROURKE: Yes, they are.

MR. GALLAGHER: The comment is that if they weren't bounded, we would continue, and that's what John had said.

MR. O'ROURKE: Right. On Slide 133, this slide and the next slide will show the ultrasonic measurement data for the upper drywell. The third column from the left shows the minimum required thickness of 541 mils.

The next column show the actual measurements taken between 1987 and 2006, and note that in some columns there are multiple numbers. These indicate separate readings taken in the same year.

MR. ARMIJO: What was the nominal thickness of the steel?

MR. O'ROURKE: Six, forty.

MR. ARMIJO: No, no. It would have to be higher.

DR. WALLIS: That's too much. It's more than that.

MR. O'ROURKE: Oh, I'm sorry.

MR. GALLAGHER: We have a --

MR. O'ROURKE: The way we define the upper drywell shell, it's made up of several thicknesses of plates. The 640 is the very upper cylindrical region.

MR. GALLAGHER: Yes, the summary that we had kicked off at the beginning was on page 14. So it shows what the nominals are, you know, for the cylinder, which is 640, the upper sphere is 722.

MR. ARMIJO: There's no measurements for what would correspond to Bay 19. Is there a reason for that?

MR. GALLAGHER: Bay 19?

MR. ARMIJO: I mean, they all eventually correspond to one of these bays in some way, don't they?

I'm just trying to see if, you know, we had in the sand bed region a lot of corrosion in Bay 19. Is there any correlation with the corrosion at the higher elevation?

MR. POLASKI: We will let Mr. Tamburro

respond to that.

MR. TAMBURRO: This is Pete Tamburro.

No, when we did the initial investigation at the upper elevations with thousands of readings, we did not find representative thin areas in Bay 19.

DR. WALLIS: It's Bay 13 that looks the worst?

MR. TAMBURRO: Bay 13 looks the worst at the upper elevations. So there's no direct correlation between the worst areas and the sand bed and the finished areas.

DR. WALLIS: It's all strange, all strange. You'd expect the water runs down in one place the worst.

CHAIRMAN MAYNARD: Apparently not.

MR. O'ROURKE: Continuing on Slide 133, the final column to the right shows our projected thicknesses in 2029, and you can note that most of the locations show no ongoing corrosion.

The trend graphs, trend graphical representations of this data are in your reference books. So we do not show those in this presentation.

Slide 134 continues with the remainder of the data for the locations that were monitored.

Slide 135 summarizes the previous two

slides, and as you saw, we have 12 of 13 locations that show no statistically observable corrosion. The location with a minimum margin, that is, the 137 mils, has no ongoing corrosion, and we have one location with a very low corrosion rate of 0.66 mils per year with a projected thickness in 2029 of 720 mils compared to a minimum required thickness of 541 mils.

Again, in summary, we discussed the initial inspections followed by random sampling that identified the areas of corrosion that are the lead indicators of corrosion on the outside of the upper drywell shell. The ultrasonic measurements indicate no ongoing corrosion except at one location which is less than one mil per year, giving the upper drywell shell a minimum of 137 mils of margin, which is 25 percent of the minimum required thickness of 541 mils and overall based on current corrosion rates, the upper drywell shell will have margin through the period of extended operation.

MR. POLASKI: Thank you, John.

That concludes our presentation on the upper drywell shell. If there's no questions on that, I'd like to summarize with our overall conclusions.

First, the corrective actions to mitigate drywell shell corrosion have been effective.

Second, the drywell shell corrosion has been arrested in the sand bed region and continues to be very low on the upper drywell elevations.

Third, the corrosion on the imbedded portion of the drywell shell is not significant.

Fourth, the drywell shell meets code safety margins.

And finally, we have an effective aging management program in place to insure continued safe operation of the risk free drywell.

CHAIRMAN MAYNARD: At this point I'd like to go back to the question Dr. Bonaca brought up a little earlier, and that's relative to the leakage. I know it's your position that the leakage is low enough. It's manageable and will be diverted away. I guess I'd like to have a little bit better understanding of what it would take.

What are you doing to try to eliminate water through the cracks, the small cracks in the liner and stuff there?

MR. GALLAGHER: Yeah, I mean, the main thing we're doing is the metallic tape and the strippable coating. So, you know, we would continue to look at improvements in that, better materials and that type of thing. You know, we had already attempted welding, and we don't think that's a right repair. We had not looked at should we do an entire replacement just because we can control what we have.

DR. BONACA: Well, one of the reasons why I asked that question is that, you know, that statement is made that one GMP leakage is insignificant. Well, I mean, it may be insignificant, but there are some operators that actually instrument the drains, the alarm if there is any water coming down, the painstaking action taken to prevent leakage.

Now, in all of the actions you have described to us at this meeting and previously, all you're doing is try to minimize the consequences of water coming down, which is inconsistent with the GALL approach to this issue, I mean, for the long run.

So that's why I was asking that question because I sense that -- and I have no idea what the cost will be -- but I don't think the cost will be, but I don't think the cost will be so much more than the money you're spending to do this kind of problem. I mean, you've gone through a tremendous amount of effort, and inspections also are costly, and I have no appreciation for what the relative cost would be.

MR. GALLAGHER: We certainly haven't evaluated that part of it. We could take a look at that. You know, the way we thought we were being consistent with GALL was to have an aging management program on the shell itself. So that's what we had. That's what our aging management program is on, but I understand your point.

DR. BONACA: Well, if I remember, I mean, in GALL, you know, a key issue as a management program is to prevent leakage, to monitor the bellows, and to monitor the steels, and the intent -- and typically it doesn't talk about the liner because it's not usual that you have liner with cracks, and so that's probably the reason why GALL doesn't speak about that.

But anyway, that's the question I had.

MR. GALLAGHER: Okay. We understand.

CHAIRMAN MAYNARD: Does anybody else have any questions here for right now?

Okay. Thank you very much.

Our agenda next calls for a break, but since we had a late lunch, I think what I'd like to do is to go ahead with the first part of the staff's presentation and maybe get through the Region 1 inspection part.

MR. ASHLEY: Can I have about two minutes to set up?

CHAIRMAN MAYNARD: Okay. Very good.

(Whereupon, the foregoing matter went off the record at 2:14 p.m. and went back on the record at 2:19 p.m.)

CHAIRMAN MAYNARD: All right. If everyone will take their seats, I think we're ready to resume.

Mr. Ashley, whenever you're ready.

MR. ASHLEY: Thank you, Dr. Maynard.

My name is Donnie Ashley. I'm the project manager for the Oyster Creek license renewal application, and I will be doing the run through for the committee this afternoon.

With us today we have Rich Conte, Mike Modes, and Tim O'Hara, who are going to discuss the NRC inspections during the fall of 2006. Hans Ashar and I will discuss the status of the open items in the licensee commitment from the last SER. And Hans Ashar and Jason Petti from Sandia National Labs will take up probably most of our agenda to discuss the Sandia analysis. And then Jim Davis is going to take just a couple of minutes to bring you back the answer that you had on questioned socketed welds.

So with that, if we could, I'd like to turn it over to Rich Conte.

MR. CONTE: Good afternoon. I'm Richard Conte. I'm Chief of the Engineering Branch, number one, in Region 1. I was the team manager for the 13th inspection in 2006 of Oyster Creek.

With me I have Tim O'Hara, one of the team members, who is an ISI specialist, and also I have with me another specialist, Michael Modes. Michael was an advisory member. He was off on another project, but he was also the team leader for the license renewal inspection earlier in 2006.

In the next three slides what I'd like to briefly do is summarize the scope and results of the fall outage. Yesterday we issued the report number 13. We have extra copies here on the table, and it is publicly available as of today.

Prior to the outage, the NRC staff had scheduled inspections for the outage, and in particular, we noted that there were certain license renewal commitments that the licensee or AmerGen was going to perform. Most of the focus for us at least was on the in service inspection, visual examination of the drywell in the torus area.

The inspection also assessed an emergent issue with the water in the trenches that came up.

The review is a multiple week inspection with the assistance of experts not only in the Region 1 staff, but also NRR staff.

The State of New Jersey representatives also observed a number of activities, including internal NRC staff conference calls during the course of the inspection.

DR. WALLIS: Are you going to describe the visual inspection results?

MR. CONTE: Yes.

DR. WALLIS: I mean separately. Okay. I'll wait for that then.

MR. CONTE: Can I have Slide No. 4?

Basically the inspection looked at the ultrasonic measurements and visual test results and the related evaluations by AmerGen. We also observed the epoxy coating in three of the ten bays. Two were entered by Tim O'Hara and one was entered by the senior resident, Marc Ferdas, who was also a member of the team.

And when you went into the bays, you could also see adjacent bays. So I would say about 40 or 50 percent of the area was reviewed.

And of course, we reviewed all of the visual VT results that AmerGen documented on their records.

We also reviewed AmerGen's efforts to identify and mitigate the sources of water which accumulated in the trenches that were previously dug out for the UT measurements on the drywell shell, and we also reviewed the potential impact on structural integrity on the concrete drywell floor and the potential conditions in the imbedded portion of the drywell shell, and we insured that the repairs had no impact on the design and licensing basis for operations.

More specifically, at this point let's go on to Slide No. 4 or 5.

We verified that all of the ultrasonic results, ultrasonic test measurements or results met the calculated minimum code required thicknesses for the area.

DR. WALLIS: As calculated by Sandia or by whom?

MR. CONTE: These were calculated by AmerGen. This is based on their test records.

DR. WALLIS: These are based on the minimum code required thickness as calculated by AmerGen.

MR. CONTE: AmerGen's calculated. We basically were in the field verifying the proper implementation of their program.

We also found no adverse conditions with respect to the epoxy coating on the outside of the --

DR. WALLIS: Would you tell me about that because I look at these pictures that you've seen, I'm sure. There are sort of yellow and orange regions. Is this an optical illusion, but in fact they really looked white everywhere or did it have yellow splotches on it?

MR. CONTE: I will let Tim O'Hara address that, Doctor.

MR. O'HARA: We observed AmerGen performing the visual inspections. The specification or procedure that they used had criteria as to what was to be reported. As part of the data sheets they reported what they saw, what the inspector saw, and they attached a picture to each one.

So the areas that we didn't physically look at ourselves, we looked at their data sheets.

DR. WALLIS: But you did look at some, physically looked at them.

MR. O'HARA: Yes, we looked at -- I looked at --

DR. WALLIS: And did they have these sorts of yellow areas or they just looked white everywhere?

MR. O'HARA: They looked basically gray or white.

DR. WALLIS: Gray or what everywhere.

MR. O'HARA: The epoxy is more gray than white.

DR. WALLIS: Did you touch these protrusions and see if they were soft in any way?

MR. O'HARA: I did not.

MR. CONTE: Continuing with this particular slide, we found no adverse conditions with the repairs in and around the trough near the bottom of the reactor vessel, and we also found acceptable the structural integrity evaluations that AmerGen developed.

Can I have Slide No. 6?

Overall we thought that AmerGen had a technical basis for sufficient justification to restart the unit. We found no safety significant conditions with respect to primary containment prohibiting restart, and there was reasonable assurance that primary containment prohibited restart and there was reasonable assurance that primary containment is capable of performing its design function throughout the next operating cycle.

With that I'd like to ask if there's any questions.

DR. BONACA: The epoxy you just looked at, the inspection is just visual.

MR. O'HARA: Yes.

DR. BONACA: And there was no -- I mean, I was following up with the question of Dr. Wallis.

MR. O'HARA: I didn't memorize the inspection criteria, but it was basically evaluate the surface, look for any blistering, cracking, peeling or anything like that, and report any of those conditions throughout the specific entire area of that bay, and that's what the inspector did.

DR. WALLIS: It's a bit hard to tell blisters from the protrusions because it's a very rough surface, isn't it?

MR. O'HARA: I don't think it would be. I mean, if you saw blistering, you'd see irregularities in even the rough surface, my opinion.

CHAIRMAN MAYNARD: Did you verify the credentials of the inspectors, verify that the AmerGen folks performing the inspections were qualified for the inspection?

MR. O'HARA: We sampled both in the UT and the VT qualification area to make sure that the folks were qualified. We didn't check everyone.

CHAIRMAN MAYNARD: Okay.

DR. ABDEL-KHALIK: Your conclusions

pertain only to the end of the upcoming operating cycle. They do not go beyond that; is that correct?

MR. CONTE: That's correct. We're relying on the current evaluation that will evaluate for the period and the extended operations.

Are there any other questions on our inspection?

MR. ARMIJO: What was your basis for saying that the water in the trenches had no adverse impact on structural integrity?

And then the second part is you mentioned or reported this tracer dye testing to try and find the source of that water.

MR. CONTE: That's correct.

MR. ARMIJO: Did you get any results? Did you find out anything?

MR. CONTE: There were some flaws, and if you remember, the 106 drawing from AmerGen or the slide had the trough and the sump underneath it and the trench. And when they did a good visual inspection of that trough, they found imperfections, including a bottle. We, at least AmerGen suspects that it was probably new construction.

When they did do this dye penetrant, they put the dye penetrant in the trough, and eventually after a day or so the dye penetrant did who up in the trench, Bay 5, which is the one at the higher elevation.

That kind of confirmed that the water is at least coming from the trench, but they couldn't rule out that water is also dripping down the sides of the drywell from the CRD area going on the concrete floor and also going out to the trenches also. At this point we believe they caught most of that water that was bypassing the sump. They took the bottle out, made repairs, and they did do a level test on the trough to make sure that there wasn't any reduction in the level. So when they unplugged it to the sump, the water was properly draining to a sump.

The basis for why there as no adverse impact is basically on the science that you heard, that our expert in the region gave us basically the same position that the water and concrete and steel environment is a high pH and highly likely even putting a protective coating on the drywell of that area.

MR. ARMIJO: Thank you.

MR. CONTE: Are there any other questions on the inspection?

DR. WALLIS: I'm curious. Maybe you're

not the right person. All of this thing here talkinga bout high pH, how do they ever get a low pH in the sand bed region to cause all of that corrosion?

MR. MODES: You're right. It's not the right people.

MR. ARMIJO: There isn't a source of --

DR. WALLIS: There's no source of acidity, is there?

MR. ARMIJO: -- basic salt. Once the corrosion occurs --

CHAIRMAN MAYNARD: Sam, will you talk into the microphone?

MR. ARMIJO: Well, I just think it's a different environment.

DR. WALLIS: You think it's neutral water, which is adequate to do it.

MR. ARMIJO: Yeah. It comes in as neutral water and then it's in protection here.

DR. WALLIS: Okay.

DR. ABDEL-KHALIK: Is there any source of biological growth between the bottom of the drywell and the surface of the concrete in the imbedded region?

MR. CONTE: I couldn't answer that question right now. No one has seen that area. You'd have to core bore in that area.

DR. ABDEL-KHALIK: Just by looking at the small area that was excavated.

MR. CONTE: Well, you observed the trenches.

MR. O'HARA: I didn't see any evidence, you know, from looking at what I looked at.

MR. CONTE: And he did look at the trenches inside.

DR. ABDEL-KHALIK: If there were biological growth in areas that you could not see, would that change the water chemistry and make it more conducive to corrosion?

MR. MODES: You're barking up the flow accelerated corrosion tree here.

DR. ABDEL-KHALIK: No, no, no, no, no.

MR. MODES: With a microbiological accelerated corrosion environment, that's basically what I'm saying, and the answer is obviously yes. If it were present, it would change the chemistry, as it does in flow assisted or accelerated, depending on the political whim, accelerated or assisted corrosion, yeah, absolutely.

MR. SIEBER: It would be rare in containment.

MR. MODES: It would be extremely rare.

MR. DAVIS: This is Jim Davis from the staff.

The way they made that containment was a shell was built first and it was sitting right by the ocean for several years, and then it was not cleaned off, and the concrete was put around it. So that was not very uncorrosive water that was down there in the sand bed region.

DR. WALLIS: And it could be biological spores coming in, too.

MR. DAVIS: There could be, but I believe they checked, and they didn't find any evidence of MIC.

MR. ASHLEY: Dr. Maynard, I think that's it for this portion. I would ask Mr. Modes, Conte, and Mr. O'Hara to stay with us in case you have additional questions.

CHAIRMAN MAYNARD: Okay. I think what I'd like to do right now is we'll take a break and then we'll come back and do your open item status and then go into Dr. Asher.

We'll take a 15 minute break. We'll come back at 15 till.

(Whereupon, the foregoing matter went off the record at 2:33 p.m. and went back on the record at 2:47 p.m.)

CHAIRMAN MAYNARD: All right. Let's go ahead and resume the meeting.

MR. ASHLEY: Thank you, Dr. Maynard.

As we identified in the original safety evaluation report with open items that was issued in August of this year, we had five open items specifically related to the drywell. Some of those items were originally identified in the audit report that was conducted by Dr. Chang's team that did the audits for those.

They were directly related to the work that Mr. Ashar was doing in Section 4.7. So we put all of the open items in the one section, but they were identified throughout the evaluation, not just in the TLAA.

The first open item on drywell corrosion sampling in the transition area. The second had to do with corrosion in the imbedded areas of the concrete. Buckling analysis, the drywell shell thickness, and the minimum available thickness margins, and also questions on protective coatings.

As the applicant identified in their presentation, the same areas that we were looking at in their subsequent actions.

Following the inspections and the audits that were conducted and in discussions with the application, they made several new commitments that were added to their aging management programs, and those were identified in our SER that was published in December 2006.

I won't read these to you, but I'll just give you highlights from those new drywell commitments. These commitments did not replace commitments. They were additive in nature. They increased the sample size in the transition area originally. They had committed to doing one sample during their inspections, and they have increased that number to four.

They've also, as they discussed, talkinga bout taking additional UT measurements in the drywell during the 2008 outage, and also on the locally thinned areas identified during the 2006 outage.

Then again in 2010 they had committed to doing the UT thickness measurements on the outside of the drywell in --

DR. WALLIS: This sounds like more than they mentioned in their presentation or have I got it wrong.

MR. ASHLEY: No, sir. I think it's exactly the same.

DR. WALLIS: It's supplementary to one.

MR. ASHLEY: Yes, sir.

DR. WALLIS: Okay.

MR. ASHLEY: They've also agreed and committed to visual inspection of the drywell shell inside the trenches. That was the last presentation the applicant did in Bay 5 and Bay 17, and to repeat those again in 2008.

They also have committed to performing visual inspection of the moisture barrier between the drywell shell and the concrete floor.

MR. SIEBER: Do you believe that if the licensee performs these additional commitments along with their other program that that represents an adequate surveillance to assure containment integrity?

MR. ASHLEY: Yes, sir, we do.

MR. SIEBER: Okay. Thank you.

DR. WALLIS: Is there some basis for that rationale? Is there some rationale for that statement?

MR. ASHLEY: The ten elements that were described in their aging management program meet the requirements of the GALL.

DR. WALLIS: So you go back to GALL.

MR. ASHLEY: Yes, sir.

DR. WALLIS: There's no attempt to sort of look at what's the risk that if they only look at a few bays that they will miss something in the critical period of time? There's no assessment of that?

MR. ASHLEY: It appears to us in the information that the applicant has provided to us that they've made a good effort to identify those areas that need to be evaluated and that they're using proper methods for identifying issues or addressing the issues as they come up and putting it in the corrective action program, which is the expectations for the program.

MR. SIEBER: It actually seems to me that what is important is the rate of corrosion or rate of degradation. So I would think that if any of these every other cycle examinations shows an increase in corrosion rate or reduction in margin, that that would constitute a basis for a reexamination of the whole program to re-determine what the correct frequency of inspection should be.

MR. ASHLEY: Yes, sir. Should they go into a period of extended operations, that would become their current licensing basis.

MR. SIEBER: Right.

MR. ASHLEY: And part of that expectation is for the applicant to make sure that their programs get evaluated and they feed back into their programs lessons that they're learning as they go through the program and manage it with the corrective action program. It's part of their license basis.

MR. SIEBER: See, right now the rate of corrosion for the last few years has been pretty close to zero, which provides some technical basis for the frequency that they have established.

On the other hand, should that change for any reason, that would prompt a reexamination of that commitment, in my opinion.

MR. ASHLEY: Yes, sir, and as you look through the commitments that have been made, they've agreed to do those things as well.

MR. SIEBER: Okay. Thank you.

MR. ASHLEY: Yes, sir.

CHAIRMAN MAYNARD: Any other questions on the open items?

MR. ASHLEY: If not, sir, I'd like to introduce Hans Raj Ashar from HRR and Jason Petti, who are going to discuss the structural integrity analysis of the degraded drywell containment.

Ashar.

MR. ASHAR: Can you hear me? Here. Plug in this one. I want to make sure they can hear me.

I'm Hans Ashar with the Division of Engineering in NRR. I'm not saying what branch I belong to because the branches are changing every day.

The first thing I want to point out, the intent of this analysis. Our intent of this study was to assess the ability of the containment shell to withstand the postulated loads.

Now, in doing so, we did look at the GE analysis that was done in '92-'93 time frame, and you heard something about it from Dr. Mehta and the applicant. But took our own part as part of the analysis methodology, and we did develop sampling and everything else. We did different than what they had done at that time.

We used 360 degree model of drywell to study the special variation of that degradation. Stress and stability analysis is a drive for as designed and degraded shell conditions for postulated loads.

So we tried to do both, first baseline with undegraded shell, and then the degraded shell. I will show you degraded shell picture a little later.

DR. WALLIS: You say "we" did it. This is Sandia.

MR. ASHAR: Sandia National Lab and NRC together because NRC is the one who funded the study, and what we wanted, we wanted to have Sandia know about it so they can conduct particular analysis, you know.

Now, I want to give you a little background why I show Sandia National Lab, and I requested my management to have this study done at Sandia National Lab.

Now, I was quite aware of earlier studies that Sandia had done on degraded containments in general, and that was meant for the severe accident studies and mainly for what is the effect of seven degradations in PWR and BWR on capacity of those containments.

Those studies were done in two negative force. It was dug up in negative force. I was heavily involved in that particular effort at that time, but when I heard about the type of serious degradation that we have seen in this particular plant, I felt that we've got to do some kind of confirmatory analysis to see that, hey, this degraded containment or degraded drywell shell can withstand those postulated loadings for which it is designed.

That was the main purpose of doing it, and Sandia was chosen because of their experience, earlier experience. They had the core ready for implementation. So they used that core that they had already developed before.

We did use wall thinning used to model degradation. So what we did was, again, we divided the spherical portion into ten bays just like what you saw earlier, but instead of being one shell thickness to all the bays, what we did was we took the average of all the readings that we knew about from the UT measurements, and we said with the average of those things we are going to assign to each bay.

And each bay had their own radar (phonetic) different from each other because most of the serious degradation was in the lower ten percent of the shell, the bay. Okay? So we took those worst conditions that they had given to us on UT measurements and we averaged them out and spread it to the one bay.

We took the same from another bay, and we studied to the other bays.

In addition to that distribution, we included two slices, thin slices of strips (phonetic) into the model to see the inclusion of buckling due to the cleanest area. We did not consider any statistic research. We are going to take the longest result in that particular bay and what was that? Point, seventy, .76, .68 inches or whatever it was, we used it in a slice of two and a half feet by one and a half feet, and we put them into the model.

MR. ARMIJO: That was just an arbitrary area selection, the two and a half --

MR. ASHAR: It was arbitrary.

MR. PETTI: No, the UT measurements we used were from in the sand bed region. They were from one specific UT measurements in 1993 documented by GPU Nuclear. Those readings were taken from the exterior, I believe, before the coating was applied, after it was clean, but then before the coating was applied. I believe that that was the case.

In that case there was in two bays below the vent line. In Bay 1 and Bay 13 there were these patches of clustering of very low points that are able to sort of carve out, and I believe in Bay 1 the description in the document of the UT measurements, it did give some approximate dimensions of the region that was thinner than the surrounding, and that's what that basis was for Bay 1.

In the Bay 13, there were no specific dimensions given. So I carried that over, the same dimensions as Bay 1, just to kind of have the same basic shape as I did in Bay 1.

MR. ASHAR: Yeah, this is general layout. Now you know very well the use. So I'm not going to spend too much time on this. Let's go to the next one.

Yeah, this shows the various parts of the drywell. Now I think you are quite familiar with this, too.

This I think I should spend some time with this.

DR. WALLIS: How many nodes did you have or mesh --

MR. PETTI: I believe the elements was about a quarter of a million elements in the --

DR. WALLIS: And they were denser in the regions of interest.

MR. PETTI: The two local areas where we had the thinnest spot under Bay 1 and Bay 13, they were thinner. They were about one inch nominal element size and about four inches throughout the rest of the containment.

MR. ASHAR: Sandia, there are a number of things that we put together. Develop appearances that define an element model, baseline model and degraded model, two models for there.

Degraded model, data came from the UT that we knew about in 1993, and UT had other containment issues, also are integrated into the degraded model.

LOCA formation and three LOCA formations were analyzed here: accident, which is LOCA plus temperature; temperature, pressure and seismic. All three are in this one.

Post accident that you heard about, this one totals one of the worst loading combinations for the shell. So we tried to use that as one of the refueling lowering, which happens to be critical for the buckling of the shell point of view.

So these are three LOCA formations considering the analysis. This stress analysis, stability analysis, they --

DR. WALLIS: Stability analysis, how was that done?

MR. PETTI: That was the buckling analysis.

MR. ASHAR: It is the buckling analysis.

MR. PETTI: It's the same as the --

DR. WALLIS: Was this done by the finite

element analysis predicting a growing instability or is it done by some kind of ASME factors?

MR. PETTI: A combination of the two. The same finite element model that was used for the stress analysis is used for the IGAN value (phonetic) buckling analysis, but the numbers that come out of that then need to be fed into the ASME N-284 procedures where there are the factors that are applied to it, to the numbers you get out of the computational analysis.

DR. WALLIS: And you're able to identify the worst mode?

MR. PETTI: Correct. The analysis gives the first mode.

MR. SHACK: Yeah, what did your worst mode look like?

MR. PETTI: There's a slide near the back.

DR. WALLIS: It's a suspense item.

MR. ASHAR: Jump back to the stress, the stress slide.

MR. PETTI: It's down here near the bottom, that little black area there, near this bottom picture where it says refueling buckling, right here.

MR. ARMIJO: Is that right under a vent?

MR. PETTI: No, it's between the two vent lines.

PARTICIPANT: You have the LOCA buckling in the thin region there.

MR. PETTI: Well, actually we didn't send from each, the typical bays. We went from center of line to a bay to a center of line of bay. So the region between the center of the vent line to the center of the vent line had a uniform thickness assigned to it. Plus you can see this real little dark area that's where there's extra refinement, where there was one of those local thinned areas as well.

So the first buckling we saw in the analysis was in between the two bays that was just adjacent to one of those thinned areas.

DR. WALLIS: There wasn't something that repeated itself every 36 degrees

MR. PETTI: No, not on the lowest mode. As you get up higher in modes they become a bit more complex.

DR. WALLIS: So you weren't as artificial as GE with their pie.

MR. PETTI: Correct.

DR. WALLIS: Of course, they had this boundary condition that forced them to have some --

MR. PETTI: Right. At least for the

degraded case, we had the same type of behavior.

MR. ASHAR: We did this one. (Speaking from unmiked location.)

MR. JUNGE: Hans, could you turn up the mic? Is there a volume on that?

MR. ASHAR: Can you hear?

CHAIRMAN MAYNARD: I think when he turns away from it, his voice --

MR. ASHAR: Oh, okay.

MR. JUNGE: You're going to have to look straight at it because when you turn your head away from the mic --

MR. ASHAR: Okay. Can you hear me now? Okay.

CHAIRMAN MAYNARD: Turn your chair more.

MR. ASHAR: This are is shown as buckling. It's a factor of safety here, for example, is 2.15.

PARTICIPANT: Three, point, eight, five.

MR. ASHAR: Three, point, eight, five?

PARTICIPANT: Yes, you said 2.15.

MR. ASHAR: Yes, 3.85. I'm sorry.

MR. SHACK: Two is required.

MR. ASHAR: Two is required. Three, point, eight, five is what from the analysis. That's for the undegraded case. These are 2.15; two is required; 2.15.

Stress-wise, the stresses are computed this way. We call it a stress ratio, but it's an analysis test which we got from the analysis, divided by the --

DR. WALLIS: Can I ask you about that? On page 54 you have these red numbers which would appear to be bigger than the allowable stress.

MR. ASHAR: On the report, yes.

DR. WALLIS: Very little was said about them in the report.

MR. PETTI: Which table number are you specifically --

DR. WALLIS: Well, any table. Each table has a red --

MR. PETTI: Right. The accident load case.

DR. WALLIS: It would appear to exceed the allowable stress. Is that --

MR. PETTI: Right. The red numbers, the one red number in Table 3-5, the way that we did the stress assessment was the one stress limit was 29 KSI. The general membrane stress was 29 KSI ASME limit. So when I was assessing the results of the analysis, I would go through and in each region, main region of the drywell, I would pick out the maximum stress from the analysis. If that then exceeded the 29, I would go back into the analysis and look deeper into where that stress was.

In the one case, in Table 3-5 in the upper sphere, that happened to be at the junction between two plates of differing thicknesses, which then becomes an ASME code, a gross structural discontinuity which has a higher limit.

So I just highlighted it in red to show that I had --

DR. WALLIS: Which is okay when you apply the ASME.

MR. PETTI: Right, the ASME. In the other cases where you're down at the lower sphere, in Tables 3-5 and I believe in 3-6, where you have a secondary stress due to the thermal loading from the accident condition, where we increased the temperature of the shell from 70 degrees Fahrenheit to 292 degrees per the load case, you do get these very large bending stresses at the junction where the shell emerges from the --

DR. WALLIS: Are those the ones in parentheses?

MR. PETTI: Those are the percentages. If you applied the limits on the column on the right --

DR. WALLIS: I remember.

MR. PETTI: -- but in the ASME code it does state that for the accident load condition, which is service level C, that there are no official checks on those stresses.

DR. WALLIS: So which is 168 percent? That seems like a large number.

MR. PETTI: Right. That's if you were checking with that number, but if you do assess the ASME code due to that thermal loading, it's not required to be assessed in the code.

DR. WALLIS: So it's okay?

MR. PETTI: Yeah, based on the interpretation.

MR. ASHAR: Under Level C currently it's okay because the secondary effects of temperature are not being considered.

DR. WALLIS: But they're real, aren't they?

MR. ASHAR: Please?

DR. WALLIS: They exist.

MR. ASHAR: Not necessarily. ASME comes out with this secondary stress kind of designation.

MR. HESSHEIMER: I'd like to just maybe

offer a comment on the analysis. When those --

CHAIRMAN MAYNARD: Could you identify yourself, please?

MR. HESSHEIMER: Oh, I'm sorry. I'm Mike Hessheimer from Sandia National Labs. I supervised the work that Jason did on the analysis of the structure. I'm also a member of the ASME boiler and pressure vessel code committees.

The analysis that's done according to the code uses the elastic analysis methods. There's no relief due to plastic deformation. So the code recognizes that there are local areas where local yielding will occur and relieve the stresses, which is why that's allowed for secondary stresses where there are gross discontinuities. There are no stress limits specified because the stresses that are calculated in an elastic analysis are unrealistically high because they don't allow local yielding of the material.

If we had done an inelastic analysis, which normally is not done for design programs, those stresses, you would have reached the yield limit in those areas. You would have had plastic deformations, and the stresses would have been self-limiting.

DR. WALLIS: That's allowed in the code?

MR. HESSHEIMER: It is allowed in the

code.

DR. WALLIS: Well, when I see the 168 percent of ASME limit, am I to be concerned?

MR. HESSHEIMER: I'm sorry?

DR. WALLIS: I should not be concerned when I see that?

MR. HESSHEIMER: Based on an elastic analysis that's correct. You should not be concerned for secondary stress.

DR. WALLIS: But suppose it were 200 percent. How big does it have to be before I get worried?

MR. HESSHEIMER: There are no strain limits defined in the ASME code.

DR. WALLIS: Does plastic give foams forever?

MR. HESSHEIMER: Essentially that's the assumption inherent in the code. Now, you could argue with the code committee, but that is --

DR. WALLIS: What's the difference between plastic deformation and a failure?

MR. HESSHEIMER: But you can get a lot of plastic deformation and relieve the stresses in that area. It's a result of performing an elastic analysis in areas where local yielding can occur, and it's recognized by the code.

I guess I would want to make one point about that, is that those high stresses occur both in the analysis of the undegraded vessel and the degraded vessel.

DR. WALLIS: Yes, I noticed that.

MR. HESSHEIMER: The effect of the degradation does not cause much of a change there. It's more of a function of how the analysis is done and the local boundary conditions in that area. So the code does recognize that at those levels when you are using only elastic analysis methods, you will get stresses that exceed --

DR. WALLIS: But how do you decide when those stresses are too big?

MR. HESSHEIMER: There probably should be some strain limits that need to be evaluated, but I think this is one of those things I think is just -- and I don't want to speak on behalf of the entire code committee -- but it's recognized as a practice that works. There have not been problems with it.

DR. WALLIS: Well, I'm very puzzled because suppose all the entries in this table were red. Then it would still be okay?

MR. HESSHEIMER: No, because not all of

them are secondary stresses.

DR. WALLIS: How do I know which?

MR. SHACK: But, again, the idea is that you can't get big plastic deformations unless the primary stresses are clad.

DR. WALLIS: Yes, right, right.

MR. SHACK: You get very localized plastic deformations in the secondary, and so --

DR. WALLIS: Right, but it just says primary plus secondary. There's no separation of the two in the table. So I don't quite know what --

MR. PETTI: The previous table has just the primary. So Table 3-5 is just the primary stresses.

DR. WALLIS: So you compare 3-5 with 3-6.

MR. PETTI: Correct, and that shows you what the addition is to get the secondary stresses.

DR. WALLIS: Okay. So the local funnel distributions, it relaxes uniplasty (phonetic).

MR. HESSHEIMER: That's correct.

DR. WALLIS: But the overall stressing of the whole thing is okay.

MR. HESSHEIMER: That's correct.

MR. SHACK: Now, you sort of calculated the buckling here for the best estimate that you've shown here. Then you sort of go through the minimum thickness study. You end up with a number that seems significantly different than the GE analysis. Are you going to talk about that at all?

MR. PETTI: We do have that one plot that's in there that shows the different analyses I ran and the different factors of safety that's kind of in one of the back-up slides we have. We could put that up and discuss that if you want to.

MR. SHACK: Yeah, why don't you put that up and discuss it?

DR. WALLIS: So you have a different mode of buckling, don't you, really? You have a different shape to the -- as it begins to distort, it distorts in a different mode from the GE mode. The GE mode is a 36 segment.

MR. PETTI: Right.

DR. WALLIS: Thirty-six degree segment repeated all the way around.

MR. PETTI: Right, right, and since we have the full 360 degree model --

DR. WALLIS: Well, I'm surprised that you get a different number.

MR. PETTI: Correct. The models are different. There are different assumptions.

DR. WALLIS: It's not realistic. Yours should be more realistic.

MR. PETTI: More realistic in the sense that we do have the full 360 degree model. We did have to take -- since we didn't have the independent data that GE had when they did their analysis, a lot of the data, and it's documented in the report, was taken directly from their analysis and then had to be modified to fit my model, the new model that was created.

So it's not surprising that the numbers are not exact. It would be surprising if they were.

DR. ABDEL-KHALIK: But the loading is the same in both analyses.

MR. PETTI: The loadings are the same. The only difference was in the seismic loading application. We used the static coefficients from the FSAR, and they had actually based theirs on natural dynamic analyses that we didn't have the data to do that.

DR. WALLIS: Is that the same kind of factors that they had? They had a factor of .2, which turned into a factor of .34 when they took account of tension and so on. Did you use that same approach?

MR. PETTI: For the refueling load case,

we did not increase the capacity factor. That's why our minimum thickness is showing higher than theirs.

DR. WALLIS: Right.

MR. PETTI: From our reading of the N-284 ASME load case, it states that that is justified when there's internal pressure, and in the refueling case there is no internal pressure. So we did not feel justified in applying that.

DR. WALLIS: Would you tell us about that? I don't know the code. Which of these is the appropriate way to proceed? I mean, should you --

MR. PETTI: There's another slide that we have.

MR. SHACK: That then is the fundamental reason you're getting the different answers.

MR. PETTI: There are two reasons. One is it's a different model. There's no way to compare directly between ours and GE. That's why we did the baseline analysis where we put the nominal original as designed thicknesses. Our intent was to then compare those to our degraded model to see really the relative difference in the stresses, the relative difference in the factors of safety from the buckling analyses, not so much to compare directly with the GE, even though we know that that will be done. We weren't trying to tie that back.

Here is the section from the Article 1500 from the N-284 SME load case, which is what we used for the buckling that GE had originally used, and this quote just states that due to internal pressure there's a smoothing of the initial imperfections; that then you could, if justified, if you justify that, you could increase the capacity reduction factor, and they have applied that and GE provided justification. We didn't feel that that was justified based on what we knew of that.

MR. SHACK: If you applied that, what would you get for your minimum uniform thickness?

MR. PETTI: We didn't do that analysis.

MR. SHACK: You didn't do that.

DR. WALLIS: Well, it's a big factor. It's a factor of --

MR. ASHAR: Yeah, 80 percent higher.

DR. WALLIS: So you would get a much thinner, an even thinner value than GE if you applied their factor.

MR. PETTI: It's possible, but we didn't do that analysis.

DR. ABDEL-KHALIK: But based on your interpretation of the code and based on the parametric result that you showed in the graph before, you feel that if a thickness were to drop below .844 inches, the safety factor would decrease below two.

MR. PETTI: Uniformly.

DR. ABDEL-KHALIK: Yes.

MR. PETTI: Uniformly, but we do know from the UT data that it is not uniformly degraded.

DR. ABDEL-KHALIK: Right. I understand.

MR. PETTI: That's why the first analysis we did we did some spatial variation.

DR. ABDEL-KHALIK: I do understand that there are differences between the two analyses, but I want to sort of compare apples to apples between the two analyses, recognizing the differences between the two.

MR. PETTI: Sure.

DR. ABDEL-KHALIK: So the number that you have here of .844 inches corresponds to the number used in the GE analysis of .736 inches.

MR. PETTI: Given the differences and the different assumptions and the different ways we apply the buckling load case, correct.

DR. ABDEL-KHALIK: Now, all of the margins reported by the applicant are based on this .736 --

MR. PETTI: Correct.

DR. ABDEL-KHALIK: -- inch uniform thickness number. That minimum thickness is taken to be the value that you calculate of .844. These margins would be considerably lower than what's reported by the applicant.

MR. ASHAR: That is correct. I think it will come out about 1.67, something like that, a buckling factor. Close to it. If you bring down the 4736 --

CHAIRMAN MAYNARD: You're facing away from your microphone.

MR. ASHAR: I'm sorry. I am, yeah. I'm sorry.

Jason, the question is regarding how much safety we would have if he used .750.

MR. PETTI: Well, we haven't done that analysis. So --

MR. ASHAR: We haven't done the analysis. That's true.

MR. PETTI: -- we can't make a statement.

DR. ABDEL-KHALIK: But if you were to extrapolate that graph, I mean, it seems like a fairly smoothly varying function. You would get down to that safety factor of about 1.5, 1.6 versus two at the .736 inch thickness. Is that correct?

MR. PETTI: If we had done an analysis at .736, the safety factor would be lower than two. I can't tell you what it would be, but according --

DR. ABDEL-KHALIK: Well, it's extrapolating your --

MR. PETTI: It would be lower than two. I can't give you an exact number.

DR. ABDEL-KHALIK: You're not willing to extrapolate.

MR. PETTI: No, I'm not willing to extrapolate.

DR. WALLIS: This is the bottom line of the whole study. You have a number and GE has a number, and GE has used some modified capacity reduction factor which we're not quite sure about. You don't use that. You've got a different number from GE. Who should I believe and what should I use?

MR. SHACK: They both predicted the number is greater than two.

MR. ARMIJO: Not at 736.

MR. SHACK: But on the condition that it is, it's 2.15. Now, --

MR. ASHAR: Correct.

MR. SHACK: -- the argument here is that you can't go and do this uniform thickness model and you have to do a more realistic calculation.

MR. PETTI: You're not giving enough credit to the shell in its current condition by doing the uniform thickness analysis, correct.

MR. SHACK: But it is acceptable from your analysis in the condition that it's now in.

MR. PETTI: That's for NRC to make that judgment, not me.

MR. ASHAR: Yeah, yes.

MR. SHACK: At least it meets the code requirement.

MR. ASHAR: No, the reason we did not use that increased capacity reduction factor -- can you hear me all right? -- was that we did not have the basis for doing it because ASME requires that if we have justification to increase even in the loads under pressure, you can do it. You go through some test data, some kind of verification data. It is correct to do so. We did not use that.

Now, if the applicant has those bases with them, we did not have a chance to look at those things. So we don't know about it. So we decided not to use that.

DR. WALLIS: So you make your decision --

MR. ASHAR: But still, but in spite of

that, we did come out with a factor of safety for the existing conditions.

DR. WALLIS: So you're making your decision based on the Sandia analysis.

MR. ASHAR: Sandia.

DR. WALLIS: Which is your analysis, not on the --

MR. ASHAR: No, I want you to -- I want to rephrase myself. We are not basing everything on Sandia. This is one part in total judgment on our part --

DR. WALLIS: But the basic decision should be based on what the applicant submits.

MR. ASHAR: The applicant submits applicant's commitment for programmatic --

DR. WALLIS: You base your decision on what the applicant submits and then you do confirmatory work.

MR. ASHAR: Confirmatory, right, exactly.

DR. WALLIS: And if it turns out that this modified capacity reduction factor was misapplied in some way, that might change your conclusion?

MR. ASHAR: I would say it would not change your conclusion because still under existing conditions it does satisfy the buckling factor.

DR. WALLIS: If they can't use the circumferential stress in the way that they did.

MR. ASHAR: Yeah, you see, that's the reason we don't want to use hard and fast number from Sandia analysis.

MR. DUDLEY: This is Noel Dudley, project manager for license renewal.

What the process is is that we reviewed the license renewal application. We asked questions on the information in the license renewal application, had responses. We had an open item, and we gathered more commitment or different commitments from the licensee and closed out the open item.

At that point the staff had made a decision that the commitments were satisfactory for maintaining public health and safety.

DR. WALLIS: I'm trying to determine if you understand the ASME method and these modified capacity reduction factors because surely part of your decision has to be made based on what is submitted by the applicant.

I don't understand that. Does somebody here really understand these modified capacity reduction factors.

MR. DUDLEY: And I don't think it's

necessary.

DR. WALLIS: It's not necessary?

MR. DUDLEY: It's not necessary because there are commitments to do UTs every two years.

DR. WALLIS: But how do we know it's safe now?

MR. DUDLEY: Because it met regulatory requirements.

DR. WALLIS: How did it meet regulatory requirements?

MR. DUDLEY: It was within the code.

DR. WALLIS: The code is based on this modified capacity reduction factor, which we need to understand, right?

MR. SHACK: Yeah, as I understand it, the current Oyster Creek analysis is a claim to be a bounding analysis with the minimum thickness of 736, and that's acceptable if you accept that it's a bounding analysis. They haven't attempted to do an analysis of the current configuration.

DR. WALLIS: But their analysis is based on this modified capacity reduction factor, which we have to understand, I think. Somebody has to understand it.

DR. ABDEL-KHALIK: Lets say you backtrack and you haven't done the Sandia calculation yet, and you're basing your decision on the applicant's analysis. And you look at the analysis and you ask your experts and they say, no, the ASME code does not allow this capacity reduction factor to be modified in this case because there is no internal pressure under this loading condition.

And if that is the case, that would have changed the safety factor from two to 1.27. What would have been your response with regard to a communication for additional information from the applicant?

MS. LUND: I think that if we do have a situation where -- and this does happen with applications that we do receive where, you know, we have some questions about the conclusions or the data or something that they've provided -- we would have to look at the assumptions that were made.

But I think what Hans had done in this case is to look at trying to evaluate it, and of course, you're saying that if we didn't have the Sandia report, but I think that it was part and parcel of trying to look at what had been done and make sure.

I think one of the recognitions as well is that the GE study that was done, it was an old study.

Okay? There were limitations to doing it in a slice. We did not try to just go through and do exactly the same thing that GE had done just to confirm the numbers for that. I think we were trying to do something that at least in Hans' and Jason's mind was more representative of what they needed to look at.

So I think that as far as the staff goes, you know, that's the type of analysis, that's the kind of thought process we tend to go through no matter whether it's this or something else.

In addition to that, I think that the point has been made both in the GE study and also in this study, too, that the way it was modeled, you know, the real situation -- I think you have to remember that the real situation is not a uniformly thinned shell. The real situation isn't the same as modeled for both of them because I think that both of them were trying to be modeled in a conservative manner.

DR. WALLIS: The issue is what is the decision going to be based on, and the Sandia model may be fine, but it's NRC work. You base the licensing decision on work done by NRC or by what's submitted by the applicant?

And if the applicant's work has this

uncertainty about it and you're not quite sure that it's appropriate to apply this modified reduction factor, then maybe the GE work is not a basis for a decision.

MS. LUND: Right.

DR. WALLIS: Then okay for you to make a decision based on your work. I'm not quite sure. I think I'm always being told that it's up to the applicant to submit a case.

DR. ABDEL-KHALIK: If I may expand on this, what in your view is the analysis of record?

MS. LUND: The applicant's is the analysis of record.

DR. ABDEL-KHALIK: Now, if the analysis of record is deficient, what would be your response?

MS. LUND: Well, I think that the discussion that has gone on here today has been there is a probably a difference of approach as far as whether or not to consider this factor. I'm not sure that we've decided that the applicant's study is deficient in that particular manner.

CHAIRMAN MAYNARD: I think we've talked about. I'm not sure we're going to get any better answer. What I would propose is that this be a specific agenda item for the full committee meeting because I do think it needs to be better addressed probably by the licensee in defending their calculation and also by the NRC on what the acceptance is.

So I would propose that we have this as an agenda item for that. I do think it's an important issue and needs to be clarified. I don't think we're going to get any further today.

MR. GALLAGHER: Mr. Chairman, it's Mike Gallagher, AmerGen.

I just wanted to make sure it was clear. So we did specifically talk about this capacity factor reduction methodology. That's what Dr. Mehta was talking about, that we consulted with the code case center. That's the issue that we went through, and the internal pressure was one way, but you know, there were other ways where the hoop stresses could be distributed and it was appropriate.

MR. SHACK: Code interpretation then.

MR. GALLAGHER: Dr. Mehta, can you come up and answer that question?

DR. MEHTA: Mehta with (unintelligible).

When we were doing this analysis, we talked to Dr. Clarence Miller of Chicago Bridge and Iron who is the author of the code case 284, and also at the time when we did the analysis, the revision was going on on 284, Revision 1.

And when we used this approach, we first actually consulted him, and then we said, well, we want to use this kind of approach and explained to him how we were going to do that, and he wrote a technical report that he agrees with this approach.

and so essentially our conclusion was that the author who wrote this code case 284, if he agrees with this approach, which would seem reasonable, and our own technical justification was in effect the internal pressure would not do much to straighten out any imperfections. It's the internal pressure as it manifests itself in tension which will pool these imperfections and make them a little more straight, thereby the reduction factor will be a little bit lower.

And so that was our own technical justification within ourselves, and then Dr. Clarence Miller agreed, and he said that he agrees with this interpretation.

MR. GALLAGHER: And just one other point of clarity. So that was part of the original analysis that was done in 1992 and is the current licensing basis that was reviewed by the staff earlier. So, you know, it was reviewed by the staff.

CHAIRMAN MAYNARD: Well, again, I appreciate your comments. I do think it would still be a good agenda item for the full committee meeting, give both the licensee and the staff a chance to revisit this and make sure they're still consistent.

MR. ARMIJO: I just want to ask a question for clarity. Did you use the internal pressure to generate these capacity factors, reductions for the refueling case when there no internal pressure.

MR. GALLAGHER: Dr. Har Mehta can explain that.

DR. MEHTA: The question, whether the refueling condition case we use --

MR. ARMIJO: Yes. Can you use that?

DR. MEHTA: Yes, we used that.

MR. ARMIJO: And why?

MR. GALLAGHER: No, he said since there is no internal pressure during refueling, what do we use to justify the capacity reduction factor.

DR. MEHTA: We looked at the average of the section in the sand bed region and determined what is the circumferential tensile stress, and subsequent to this code case and 284, Dr. Miller wrote a WRC running research council bulletin 406 in which he had a procedure where from the circumferential tension he calculates the coolant pressure and then puts into the equation to raise the capacity factor.

MR. GALLAGHER: Right. So pressure is one way. There's other stress. Other stresses command--

DR. WALLIS: Well, I understand that Sandia did not use the capacity reduction factor.

MR. PETTI: Right. As you can see in the quote there it says justification can be provided. So we just didn't have any justification to apply that, and our --

DR. WALLIS: But there is no internal pressure really.

MR. PETTI: Correct.

DR. WALLIS: It's just sort of a surrogate stress.

MR. PETTI: Correct. It's a matter of the interpretation of the language there, and we --

DR. WALLIS: Plus there must be some physics behind this sort of thing.

MR. PETTI: -- did not have any other documentation.

DR. WALLIS: There must be some real physics which says if you have a circumferential stress you can do something with it, not this inventing an unreal pressure.

MR. PETTI: But that's why we did have justification to do it. That's why we didn't apply it. If they have justification, we weren't -- that was not made available to us. So we didn't feel we were justified in applying it.

MR. GALLAGHER: And Chairman Maynard, we can definitely talk about it at the full committee if you'd like. I just wanted to make sure it was clear that this capacity factor reduction we did talk specifically about and the justification was with the author of the code case. So I just wanted to make sure that was clear.

CHAIRMAN MAYNARD: And I acknowledge you did discuss it and you did provide that information. I think for the NRC staff probably more so than for you, but part of this now becomes a legal question as to what is the analysis of record. What can you and can you not take credit for?

And I think it's probably more of questions for the staff. I think it would be good for the licensee to re-address that again back at the full committee meeting, but for the staff to take a look.

MR. GALLAGHER: Okay. I understand. Thank you.

DR. ABDEL-KHALIK: This opinion was sought and obtained in 1992 when the analysis was done, and perhaps it would be prudent for the applicant to seek an interpretation of the current interpretation of the ASME code.

CHAIRMAN MAYNARD: Sometimes there's a difference between an opinion and official approval letters. So, again, I think that both the applicant and the NRC staff need to revisit this and come back to full committee meeting and address the acceptability of it.

MR. ASHLEY: Yes, sir, and if I might add, from the safety valuation report standpoint, the commitments that the applicant has made to us is that when they do these next outages and when they do these next testing, they will inform us of the results of those tests, and if there is anything that we felt like would put them below the margin by their definition or by this definition, we would take appropriate action at that point, but it would be monitored and it's not just to put the report out and then be done with it because we felt like the commitments that the applicant made we'll monitor that.

CHAIRMAN MAYNARD: I want to make sure I

understand what I think I heard you say, is that when you're informed of the results that if they were below what the Sandia calculation is, you would be made aware of that.

MR. ASHLEY: If they were different from the numbers they got on this outage, any difference at all, they would evaluate.

MR. SHACK: Yeah, I mean, I think if you see significant thinning, you would have to come back and look at it again because unless you accept this, you can't accept the bounding analysis. Therefore you have to analyze the as is case, which apparently has been done.

DR. WALLIS: The question is will it buckle now. That's the real question.

MR. SIEBER: Doesn't it stand to reason that if you can't accept some analysis now, then you can't draw a conclusion from today's data?

DR. WALLIS: So what's the basis for drawing the conclusion?

MR. SIEBER: That's right.

DR. WALLIS: From any data.

MR. ARMIJO: Well, if you can't use the Sandia analysis for drawing a conclusion, why are we even talking about it? That's nonsense.

CHAIRMAN MAYNARD: But from what I understand, both analyses show that it's okay today with a safety factor of two. So it really gets into what is the real margin there. Is it the licensee's calculation or is it the Sandia calculation, which could impact what the future inspections and stuff might have to be looking for.

Both of them showed that today it was okay.

MR. ARMIJO: Right, and I think that the GE calculations made in what, 1989-1990, used the 736 number when, in realty the number is much, much higher based on measurements in 2006. So in any future discussion we should be talking with the realistic dimensions of this containment because I think we're just not using the margins which we've measured and then using margins which you can argue whether they're valid or not. They come from stress or pressure or something else. So I think we should just update that GE study to using current values might solve the problem.

MR. CU: Right. This is P.T. Cu.

I just want to make a comment that we understand the members' concern, and I guess we don't have the ready answer to you. We'll come back to you.

CHAIRMAN MAYNARD: I do think it would be best to address it at the next meeting and have everybody a chance to be thinking, talking some factual versus what they think may be the case.

MR. ASHLEY: Did you have anything additional?

MR. ASHAR: This is the last slide. It may be amazing or confusing.

MR. SHACK: It's hard to say we're not counting on the same studies.

MR. ASHAR: We are, but to understand, it's a three prong approach in decision making from a regulatory point of view. The numbers are not something that strictly we're going to adhere to. It is the programmatic thing that we are working together with because we knew that the real difference between what they've done in 1993 and what we are doing right now. So we expect the differences.

Now, this difference is a little critical. I agree with you, and we have to come to some kind of determination as to which way to go.

DR. WALLIS: Well, the Sandia study is much more realistic than the GE one.

MR. ARMIJO: It's a modern analysis.

DR. WALLIS: It's 360 degrees, puts in

different thicknesses in different bays, and so on. Now, the question is whether you can use it as the basis for your decision.

MR. ARMIJO: That's for the lawyers.

MR. ASHAR: We were using the logic if we are going to use this in one particular portion, but you are quite right. There is going to be a problem, and we have to work with it.

MR. SAMMADAR: This is Sujit Sammadar with NRC.

Typically we never use NRC studies because it's a back of the envelope to justify anything that the applicant has. The applicant stands on their own merit. So the Sandia study will not be a justification for anything, but all it demonstrates to us is given the current condition, what they have concluded, we get the similar conclusions from the Sandia study even though the two studies do not line up.

There were differences in how the studies were conducted and what they give us, but the bottom line conclusion is about the same. They still maintain that factor of --

CHAIRMAN MAYNARD: I understand, and again, I believe what the issue is is that the staff has taken credit for the applicant saying they meet the code, and the real question is an issue has come up as to what does the code require and does the applicant's analysis meet the code, and so I guess what we really need to do is the staff's position and justification that the applicant's analysis meets the code.

MR. CU: We will get back to the committee.

MR. ASHLEY: Hans, did you have additional?

MR. ASHAR: No, I don't think so.

MR. ASHLEY: With that --

CHAIRMAN MAYNARD: Any other questions for the staff?

MR. ASHLEY: We have one additional item.

CHAIRMAN MAYNARD: We have got the socket welds. I'm sorry.

MR. ASHLEY: You had a question at your previous meeting about socket welds, and Jim Davis is going to give you some information.

Jim.

MR. DAVIS: I'm Jim Davis from the staff.

CHAIRMAN MAYNARD: Can you speak up a little bit and can we hold down the side conversations?

Thank you.

MR. DAVIS: We have gotten a commitment from Oyster Creek to look at one socket weld destructively, and we were questioned on the reliability of that. So what I did was a lot more research.

What the issue is is for Class 1 socket welds, Class 1 and Class 2 socket welds, less than four inch nominal pipe size, should they be included in the one time inspection of small bore piping. The GALL report does not include them.

I had extensive discussions with the technical staff on this issue, and what we concluded is currently IWB and IWC require a surface exam for socket welds, between one and four inches. There's no requirement for socket welds under one inch, and all of Oyster Creek's socket welds are under one inch.

I looked at the literature and I found out that most failures are vibrational fatigue, and they initiate on the ID. So doing a surface exam doesn't really help you much, and the NRC position is if it's ID initiated doing a surface exam is not appropriate even though it's in the code, and they've been granting relief to use a VT-2 or visual exam.

So the conclusion we drew was that looking at one or even several socket welds will not really prove very much, and so that we're not going to require socket welds be examined. So that's basically the story. So there will be no additional examinations of socket welds required.

CHAIRMAN MAYNARD: All right. Any additional questions on socket welds?

MR. SIEBER: I think that was my issue. I'm satisfied with that answer.

CHAIRMAN MAYNARD: Okay.

MR. ASHLEY: The conclusion will have to await our next meeting.

(Laughter.)

CHAIRMAN MAYNARD: Okay. Any other questions for the staff right now?

If not, I'd like to thank you for your presentation, and I believe next we have Mr. Gunter and Mr. Webster.

Take a moment or two here to transition seats.

(Whereupon, the foregoing matter went off the record at 3:46 p.m. and went back on the record at 3:48 p.m.)

CHAIRMAN MAYNARD: I think if we can get

everybody to sit down and be quite, we'll go on with the comments from the public.

And before you get started, I'd like to say that I appreciated getting a copy of your slides. I understand there may have been some changes since then, but at least to get some prep work there done, and so I really appreciate that and look forward to hearing your comments.

So I think, Mr. Gunter, you're going to lead it off.

MR. GUNTER: Thank you.

I'm going to offer just a very brief introductory remark. My name is Paul Gunter. I'm Director of the Reactor Watchdog Project for Nuclear Information and Resource Service.

We are one of six intervenors before the Atomic Safety and Licensing Board. We offered one, a single contention.

Subsequent to our communications with AmerGen on the drywell liner corrosion issue and subsequent to our filing of the single contention, we do recognize that AmerGen has offered a set of commitment changes.

However, the commitment changes still raise concerns, and we're here today to address some of those concerns, and I will be turning it over to our attorney in this proceeding, Mr. Richard Webster. Mr. Webster's background is that he has a Bachelor's degree in physics from Oxford University, a Master's degree in engineering hydrology from Imperial College. He has his law degree from Columbia Law School, and he is currently the staff attorney for Rutgers Environmental Law Clinic.

So Richard.

MR. WEBSTER: Thank you, Paul, and thank you to all of the committee members here for inviting us along, and thanks for the time last time. I'll try not to overrun in the way that I did last time.

I'm presenting here on behalf of a coalition of environmental groups and citizens groups who are collectively known as the Coalition to Stop the Relicensing of Oyster Creek.

So I just want to review what we did at the previous meeting first and then move into what's new. So the previous meeting I think we decided that we should put the horse before the cart. That means that we should first establish margin and then for both the sand bed and the imbedded region, and then we should determine whether that margin can be maintained, and if so, how it can be maintained.

Now, at the last meeting we realized that in terms of establishing margin there are significant issues in terms of paucity of data, nonrigorous statistics, large uncertainty, unrealistic modeling, and many cumulative, unjustified assumptions.

In terms of whether the margin can be maintained, we realize there are significant issues of equipment failure leading to ongoing leakage, operator failures, uncertainty in the measurements, lack of data to predict the corrosion rate, and in the scope and frequency of the monitoring.

So just to emphasize those are the key issues, so far the applicant has measured less than one percent of the sand bed area, and it says the last measurements are in '94, where they have now done the measurements in 2006. So we have a gap between '94 and 2006. I was kind of surprised that the applicant used the '96 numbers in their simulations. I think those numbers should be excluded. They've been shown to be systematically in error, and therefore, I think we really only have three valid measurements, not four.

So when the applicant is doing its statistical analysis, I really don't think they should take credit for four measurements.

Again, last time we found that the applicant had fitted the data to the normal distribution by segmenting the data and editing out pits that were beyond a certain number of standard deviations. There seems to be no change in that and no word from the applicant about that. I guess they're still doing that.

The acceptance criteria are based on the modeling and idealized geometries. I think the Sandia report has addressed that to some extent.

The margin was not established, but there was a .064 inches was claimed. That's still the same now.

We had argued that the visual assessment of the coating alone was inadequate, that we need better detection of corrosive conditions and faster response, and that there were no measurements in the imbedded region.

Now, what's new so for the sand bed, we had the historic results and we now have the results in 2006. For the imbedded region we now have one 42 point grid taken in Trench 5 in 2006, and they found water on the inside of the shell as we've heard during the last outage.

So those are the primary new factors, and

I guess the Sandia study is the other big factor. So I'm going to start, first of all, while talking about the sand bed. Then I'll just wrap up by talking about the imbedded region.

And before I forget, I've also sent a letter sweeping up a couple of questions that were left over from last time, and actually raising a couple other issues to do with the torus program, the potential missed commitment in the torus program, which I have been unable to resolve as of this point, and summarizing a few of the items I'm going to present here.

So I think we are fully familiar by now with the schematics. We don't need to dwell too long on those.

So the Sandia study, I mean, let's pick up here. Obviously the Sandia study is a very serious concern. We have a national laboratory where the supervisor of the study apparently is ASME committee, and they have decided that the modeling done by GE basically got the wrong answer. There's an assumption about the capacity reduction factor that was unjustified.

So that was supposed to be a confirmatory study, and Sandia did caution that it cannot be used as an absolute study. It can only be used as a confirmatory study, and basically what we find is that the confirmatory study has shown lack of confirmation. The assumptions that went into the GE study, the confirmatory study, are incorrect.

I mean, there are two big problems. One is the capacity reduction factor, but the other, as we've heard, is in the model because the GE study was a 36 degree symmetric model. It couldn't predict the lowest mode of buckling.

And so we think when you get that kind of situation what's needed next at minimum is a more refined approach to modeling. Just having two models that don't agree with each other and then hoping for the best we don't think is an adequate way to proceed.

I mean, the purpose of the Sandia study was to see what the effects of the degradation were, and what the Sandia study finds is that there has been a 43 percent reduction in safety factor for buckling the sand bed region under refueling conditions due to the degradation.

As I said, it found that 8.44 inches uniform thickness should be the -- is the number Sandia can justify as opposed to .736 inches, which both the applicant and GE want to adopt. And it has found that the safety factors for buckling under refueling conditions were -- actually they were predicted at 1.95 in the upper drywell, which I was kind of surprised that no one mentioned because that is less than required, a factor of two, and they're predicting 2.15 in the sand bed.

Now, the problem with this is I think, Dr. Wallis, the last time you mentioned the sensitivity analysis is going to be critical in this. You start to change the assumptions a little bit and the outcome could change a lot.

So what we have here is a model that's based on some assumptions that are conservative and some assumptions that are not conservative. If we start to think about what the uncertainties in this prediction, I think we see that there's an uncertainty. We know somewhere the factor of safety for the model actually or for the drywell overall has existed in 1992, which is what the Sandia study models, is somewhere on the order of two. It could be more than that; it could be less than that. We know it's on the order of two.

But I don't think that's enough to justify relicensing. What that shows you is that we don't really know whether it meets the code or not. We know that in fact what it shows you is we know there's a slim chance probabilistically that it doesn't meet the code.

The problem with the Sandia study or the lack of conservative assumptions are that actually there was some observed filling in the sand bed exterior measurements in October 2006, and in fact, I've looked back at the tables, comparing the tables presented by the applicant to you in the information package they sent and the tables of degradation. They degraded modeling in the Sandia study, and actually the two for Bay 1 don't reconcile.

The Bay 1 local region, Sandia used .705, but according to the applicant on page 612, Table 2, UT thickness measurements in '92, the thinnest measure in Bay 1 was .68. So already the Sandia model looks like it didn't take account of the thinnest measurement for '92.

Now, if we move on, look at the thinnest measurement for 2006. **It's actually .665. So already there's a problem here. The Sandia model doesn't predict what at the current state of the drywell is. It predicts what -- well, actually it predicts what Sandia thought it was, but what it doesn't look like it really was back in '92.**

And the biggest one I've said before is that Sandia did not estimate the uncertainty of this prediction, didn't really do a lot of sensitivity. They did not move those degraded regions around to see how they would change it. They did not look at the uncertainty in the measurements themselves, and along the way you can point to various other assumptions which may not be conservative.

Now let's look. This is the applicant's claims basically, and so you can see that what's happened over time here. In 1969, if we look on the left-hand side at the small area thickness, this is what the applicant is running for single point measurements, and so originally I'm just taking the nominal, and then on a single point basis actually the applicant measured from the inside, .603, in 1992, but subsequently they've sought to correct that measurement, and I'll go into this in more detail later, but they're now saying that the thinnest measurement actually measured from the interior is .648.

And the thinnest measurement in 2006 measured from the exterior was .602. So from the applicant's basis they say, well, you know, based on the GE study, .536, we'll figure that is acceptable.

So that's fine.

The problem with that -- well, I'll go into the problem with that later.

The way you see is at minimum we see a dramatic reduction from 1969 to now, a huge reduction in the margin, and the same thing for the mean measured thicknesses. These are looking at the grids that the applicant has used, not the exterior measurements.

Again, taking the nominal 1969, it comes down to .8. As we've said, if .736 is acceptable, then you have a margin of .064. The question again is uncertainty. What is the uncertainty of those measurements? What's the uncertainty in the acceptance criteria? Is there a possibility that those two bars may overlap?

And, again, you see a dramatic reduction in margin from 1969. This is simply not the same plant that it was in 1969, and we see the same thing with the pressure. I mean, what has happened over time here is as the margins have gotten narrower and narrower and narrower, the conservatism in the analysis has gradually been eaten out of the analysis. We saw with the pressure initially there was a conservatism in the analysis. So the pressure was going to be 66 psi.

Then because they didn't meet that, they took that conservatism out, and so at minimum even by the applicant's own admission, this plant has far narrower margins than it had in 1969. I mean, based on the modeling that we have actually it's our contention that we don't know if there's any margin at all right now, and the applicant certainly has not demonstrated an ability to maintain even the margin that they claim. So let's move forward in that.

I mean, I'm kind of attached to actually looking at the data. So I decided to have the data plotted out, and these are all based on the GE acceptance criteria of .736. So I'll sort of go through and then give some illustration if we change that to the .844 that Sandia is predicting.

So this is Bay 1, and I think that's interesting about this is that you see a pretty large area in the middle here that's got thinness to it, and then you see another area down here that's thin, too, a separate area. So there's another nonconservative part of the Sandia model. They have one degraded area and actually have it directly underneath the vent pipe.

Actually there are two -- I mean, look.

These are the only numbers we have for this area or that we have in the 2006 numbers, but I actually haven't seen those. The only presentation of those that I've seen is the ones given in Table 2 in your packet. So this is the only drawing I'm able to create from this.

And what it shows me is that we don't know much about this area, but what we do know is there are probably two scenarios, the local in 736 and they are reasonably extensive, and they're probably not centered around the vent pipe.

And if we were to up the required amounts to .844, because remember the applicant's methodology for those acceptance criteria is to take the uniform thickness requirement and compare that to -- well, actually let me backtrack. The applicant has a strange approach to these numbers. Let me go on and show you something here.

The applicant, obviously, if it decided that each of these numbers represents an area, it would have a problem because what it's doing for the .25 square foot grids it compares them to the uniform thickness, and so it says, well, are my grids less than .736. If so, I have a problem.

The difficulty -- but then for these, the applicant actually applies the individual measurement amount and says, well, for these individual measurements, are they less than .536 or whatever the figure is, .5-something.

Now, the problem with that is each of these measurements could well represent an area that's as big as or bigger than a quarter of a square foot. Indeed, the report, for one, they actually -- and I'll go through it -- actually tells you that the area represented by the point is bigger than a quarter of a square foot. So the applicant's approach to acceptance is completely inconsistent.

Sometimes they take the average of a quarter of square foot area and compare that to the uniform criteria, and sometimes they compare it to the individual point criteria, and sometimes they take the individual point which represents an area of over a quarter of a square foot, but then don't use the area account, the area acceptance criteria.

And I think earlier on you hit the nail on the head when you were asking about how do they come up with these areas that are thinner. As far as I can tell if the applicant measures on the edge of the grid a point that's less than .736 -- I'm talking about the results taken from the inside now -- if they measured that, they don't then move the grid over and take another grid and move the grid up and take another grid and try to map out the area that's thinner than .736. They just move on and then just average that out.

And conceptually we think that's a problem. They need to be measuring the areas. However you cut off though, where you set the criteria, which is obviously a matter of debate, but minimally you have to measure these areas and figure out how big they are, and then once you know how big they are, you can actually, you know, think about modeling.

For the moment we really have no idea how big they are.

Now, this is just Bay 5, and the reason I put this one up is to show you that if we compare Bay 1 with Bay 5, Bay 5 is the bay with pretty much the least corrosion, and I think that I heard the applicant say they selected Bay 5 for the trench because it had the least corrosion.

And so it struck me as kind of strange that they dug down and measured the corrosion in the imbedded region in Bay 5 because you kind of anticipate that Bay 5 would have the least corrosion in the imbedded region, at least in terms of the exterior imbedded region. But I'll come back to that when I do my imbedded region point.

So this is Bay 9. Again, if we up the criteria now to .844, you see that they have a large area over here, which is thin.

This is Bay 11. Actually if you up the criteria to .844, there are no measurements thicker than .844 in Bay 11.

This is Bay 13. It's interesting. Sandia said they weren't able to put an amount on this. I actually found an E-mail from the applicant that characterizes this area as 15 by 43, 15 inches by 43 inches, and then as I said before, this is .7 in Bay 13. If you go back to the original report, the report says that .7 represents an area of a quarter of a square foot. It says it's no more than that.

Of course, that was in 1992, and then these are the actual measurements in Bay 13, and what you see is that that's the .7 there. That came in as .618. So there's a quarter of a square foot area at least which is at a thickness of about .618.

Now, the applicant says, "Oh, that's okay because, you know, there's that 536 criterion, and the problem with that .536 criterion is there's actually what GE showed was that a uniform thickness of 736 mils. This sand bed region exactly met the code.

What it actually showed when you go back and look at the reports is that if there's a degraded region that's thinner than .73, that's thinner than .736 inside that uniform sand bed region, it's about ten percent below the code.

So that GE report, even if it's right, doesn't really tell you that you can allow areas of more than one square foot to be thinner than .536. In fact, what the applicant has said if you turn to my letter, what the applicant has unequivocally said is the areas corrode at less than .736 inches could be contiguous provided their total area did not exceed one square foot.

Now, the problem I have with this is it is looking a lot like there's an area in the middle there that's exceeding one square foot. It seemed like they exceeded that in '92 as far as I can tell.

Now, I note what the response is. We selected these thinnest points. So those are biased towards the thin side. Well, yeah, that may be true, but we don't have any other points. We really don't have that much idea what's in between those points. We know it's rough. I mean I question whether, you know these guys can really spot the thinnest. I think somebody else was questioning that, whether they can really spot the thinnest area.

What we do know is that this large area here which is thinner than .736, or even if .736 is right, which obviously Sandia doesn't think so, you still have a problem or the applicant still has a problem because they've said that it should be less than one square foot, and it simply isn't.

So now we tried to come up with some statistical approach. I mean the applicant's statistics, as we heard earlier, were shaky, and so we tried to help them out a little bit here by doing some statistics.

Dr. Hausler actually ran this little statistical analysis looking at extreme values. Very simple, a reduced area on the bottom in terms of ranking, and then the pit depth of the side, and so you know, what you find is we extrapolate out, is that there's obviously a chance they didn't find the finish point. If these are randomly selected, which they're not, if they were randomly selected, there's a 2.5 percent chance that the mission would give a thickness less than .536, and at 99 percent certainty, the thickness of each point is .449.

Now, as I said, we know they're not randomly selected. I don't really know. We haven't figured out how to do the statistical treatment for non-random selected points, but somebody had better figure this out because there is a chance when you get these measurements that they miss the thinnest point and, therefore, there's a chance that they're already going below the acceptance criteria. You just can't take the point you happen to measure, and so that looks okay to me and so that's fine.

You really need to do some extreme values, and I think we talked about this before, and the other thing you really need to do is figure out what these challenges are. Now, you know, we had a discussion before about 95 percent. What's the basis of 95 percent, and it's an issue we rate. If one in 20 times you find your containment system isn't working the way you like, is that acceptable?

It doesn't sound like it to me, but you know, I don't really -- I haven't really gone through all of the analysis to figure it out, but what I'm hearing is nobody else has either, and that's what worries me or worries us as a group, is that nobody has really figured out what chance of this thing not working is acceptable.

We know there is a chance it doesn't work. The question is how high can that chance be. The applicant appears to be saying five percent chance is okay. I don't know if that's the NRC position. I certainly haven't seen the NRC position, the staff position anywhere specifically addressed, but I think that's something we really need to look at in this case.

I want to get back to the errors. What we've done here is actually just taken a very simplistic -- just taken off that graph and I start if you go back to the -- just come back. So here we are. If you include those points, those higher points, then I think the average comes out to just about exactly 736.

So I said, well, let's just fiddle around with it and carve that end off and see what we get then and let's cut this end off and see what we get then. And then we know that this point is around a fourth of a square foot, and let's put that on the graph, and that's what we've done here.

So if your area, a quarter square foot, you know is about .62 inches, it actually comes out to about 2.5 square foot, that area that I indicated with both sides cut off. That comes out to about .68

inches, 3.75 square foot, to around .71 inches, and then 4.4 each square foot, pick up 27 points.

So, again, you do have significant areas that are thinner than .736, and it seems to me that what the GE modeling -- even if the GE modeling is right, what it's showing is that if it was uniform with those indentations it wouldn't meet code case.

Now, we know its not uniform with those indentations, but we really -- you know, we haven't seen any modeling from the applicant on how to deal with that. We've seen a lot of hand waving, but no actual modeling, and the applicant has said, remember -- you know, the applicant has stated -- let me say it again -- areas corroded to less than .736 in thickness could be contiguous --= I'm quoting you from here -- could be contiguous provided the total area did not exceed one square foot.

Well, so it looks like what the applicant is saying is that if this graph is right, there's already a problem, and I just did a little look at the sensitivity of thinning. I think no surprise that thinning the area - -the area that's thinner at a certain point is actually in proportion to the square of the thickness or the square of the thinness if you want to look at it that way.

So, in other words, although the corrosion goes linearally, the area will increase with the square, and so what you end up with is a graph where here I've taken -- obviously the cell is .736 inches thick, then there's no area that's less than .736 inches, and here I've taken the known points as the one that the applicant said was quarter of a square foot, applied a cone shape, and then extrapolated it if it was a cone shape just for that one point, that .7.

What you see is that, you know, no surprise, that the area goes up quite quickly with the error and that the measurement error, which here I've put in .02, which is the applicant's measurement error, the measurement error makes it a parallel difference to the -- well, let's put it this way. There's more -- the error in the measurement magnifies in terms of the area.

And so I think what that means is that certainly for the Sandia study you need to be careful about the sensitivity to the area, as well as the sensitivity to the placement.

So now I'm going to more formally look at these -- oh, before I finish up on that, I just want to turn your attention to Slide 101 of the applicant's where they plot out all of their results. What it really shows you is that at May 13 the thin area is not directly under the downcomer at all. The thin area that the applicant has documented is somewhere in the middle of Bay -- oh, this is actually Bay 19. In Bay 19, the thin area they're done is actually similar to Bay 17 and Bay 19.

And again, you know, there's a thin area there. That's not in the model. There's only two thin areas in the model. So, you know, the claim that this model is bounding I think is not. It just isn't justified. I don't understand any justification why the Sandia model would be bounding.

So moving on to the 2006 external results, they're presented in a rather opaque way. I haven't got a slide, but they're on the Table 2 in page 612 of your package. Basically it presents measurements from '92 and measurements from 2006, and I'll just show some statistics on those, but the problem is we don't know what points they were taking out. So it's very hard for us to do good statistics on those because they obscure by the data presentation where the points were.

What we do know is that the thinnest point measured decrease from .618 to .602. The largest rupture we can see from that table was .039 inches. I think the conclusion is that the shell is probably thinner than it was in 1992. Well, there's a couple of things we can conclude, but I'll go through those, and I just want to note the .02 inches of corrosion doesn't sound like a lot, but even if you accept the applicant's contention, which we don't, but even if you did, the margin is .6 -- .064.

Point, zero, two is a lot. It's a third of that. So here are some more detailed statistical treatment of the results that we have, which is not that many, and what I want to point out here is that in Bay 1 the number of areas thinner than .736 increases by one, but which is consistent with the idea there is thinning going on in Bay 1 because if the thinning occurred, then an extra point could have dropped below .736 in the intervening period.

Even though an extra point appears to come into the analysis, the mean still drops by five mils.

Now, moving on to Bay 13, strangely the applicant reported nine points that were less than .736 in 1992 but is now reporting only six points. So, again, we seem to have some magic metal going on under here or something is going on because either they can't find these points or something strange is going on. I really don't know what it is.

DR. WALLIS: Let me try to explain. These green things indicate a number of measurements in that range.

MR. WEBSTER: That's right, a histogram of the measurements..

DR. WALLIS: And the scale is such that there are -- it seems you should change the scale.

MR. WEBSTER: Yeah, the scales don't match up, yes.

DR. WALLIS: The scales change.

MR. WEBSTER: My apologies for that.

DR. WALLIS: So I assume that on the left there's the smallest square is one reading.

MR. WEBSTER: So, right, I think that's one reading.

DR. WALLIS: And then one reading and then the next one over is a skinnier thing. It's a smaller -- yeah, okay, but the smallest thing we see is one reading. Okay.

MR. WEBSTER: Yeah, there. That's the --

DR. WALLIS: So it's one, one, two and two.

MR. WEBSTER: Right, right. And then the mean, the only results that I have or that we have as a group are the ones the applicant reported, which are the ones that were less than .736. There are other measurements, but I haven't seen any data presented on those. So I can't comment on those, but this is what we have to analyze and so I know it's an imperfect job, and I apologize for that, but that's the best we can do, and we were rather hoping the applicant might do a better job, but it seems like they decided not to.

So what you say for Bay 13 is that there's around 20 mils of thinning. Now, whether that's statistically significant is a question because there's a lot of variation. These results, obviously, you'd have to match up the points to determine whether it's statistically significant.

But at least what it means is that you're shifting the center of the distribution around your uncertainty. Let's put it that way.

So there's an apparent thinning observed, and I think the applicant tried to deal with this by saying that the two measurement techniques are different. So they're not directly compared.

But you normally expect the applicant to have employed a measurement technique which didn't have a systematic error. I mean we already castigated the applicant for using the 1996 results which it did turn out did have a systematic error. So it would be very surprising if it turned out to be '92 results taken on the exterior of the dry well also contained a systematic error.

Normally you would expect a more up to date technique would have smaller random error, but you'd still be around the same actual physical, you know, measurement. It's only if there's a systematic error that it would make the two non-comparable.

And so the applicant appeared to say that on this slide -- or maybe I'm misinterpreting -- what he appeared to say was that there was such a systematic error due to the curvature of the drywell.

Now, I didn't quite understand the slide because the drywell is concave and there are convex bits in it, and the probes seem to be pretty small. So it's kind of hard to see how that's going to be able to give you two mils, but it's possible, but even if that's true, I think that's a serious concern. If what we had here is an applicant that relied on measurements that it knew had a systematic error, I think there's a problem there.

I think it more likely -- I mean, there's two other possibilities. None of them are very palatable. I mean, I think this is why the applicant decided not to discuss this issue. The other possibility is there's external corrosion occurring despite all of the preventive measures take. Now, because all of the coating came in as satisfactory, that would mean that the corrosion could occur when the coating is visually intact. So that would be an unpalatable finding.

The other possibility is that the internal corrosion, and you know, we have water inside the drywells identified as normal operating commission in 2006. So that's certainly seems to be a possibility.

And I was thinking about this actually while we're presenting. You know, you have an interesting situation. It seems like the grids measure from the inside and not really showing significant change. But the points from the outside are showing some change, and I think what that tells you is that once of the potential explanations is corrosion from the inside. You wouldn't get the corrosion on the inside where the concrete curve isn't there, which is where the interior measurements are taken, but you might get it where you're below that curve.

And so the way to explain -- I think the most logical way to explain the difference is to say it's the most likely answer is that corrosion on the inside is occurring, but I mean, that's by no means a certain conclusion, but you have to pick one of these three unpalatable explanations.

So I think I previewed this before, why there's no margin left. The problem is even for the points that represent an area of over a quarter of a square foot, the applicants only applied the point acceptance criteria. The .536 doesn't really work as an explanation because you're getting below code in that particular situation.

So the .736 if the model is right, you know, you might be able to justify that, but the problem is that you've got areas that are up to four square foot that are thinner or were thinner than the .736 even in '92, and sine then those areas have probably expanded either because there was a systematic measurement error in '92 or because there's corrosion somewhere.

Now, the margin failure has obviously increased a little bit by around .02 inches, and so you know, at best it's the worst quarter of a square foot is now around .6 inches thick, and obviously if you adjust the criterion to 844 mils, then what you find is that four of the 12 grids measured from the interior fail significantly and that margin is insignificant for two others.

And the big problem with Sandia are right in terms of the uniform thicknesses, but the applicant doesn't have any way to know when it takes the measurements what's acceptable. The acceptance criteria are all hooked around the GE model. So the GE modeling -- Sandia are right in the GE modeling used an overly optimistic factor. Then the applicant has no way. I mean, you saw all of the graphs that the applicant presented all had these lines for .736. You know, on the lines they show would all have negative margin.

So I think we know what the operator approach to the margin was. I mean, the interesting thing is when they took the external measurements in '92, they actually took account of those measurements and said that they assessed that the entire bay of Bay 13 had a average thickness around .8.

It's interesting now that we see now assessment of the overall thickness even though the measurements on the inside came in thinner, and you know, the NRC really got this right in the past. They were saying that in order to consider the corroded areas' discontinuity, the extent of the reduction in thickness due to corrosion shall be known, and that's really what you were saying. You don't need to just track the minimum thickness here. You also have to track the extent of the thinning, and then if you're going to justify safety or that it meets the code, you really need to do an even more realistic model. It takes the extents of the thinning, you know, which is basically what stress consultants told us back some time ago when we hired them, is that until you have measurements that tell you both the thicknesses and the extent, and actually they said, you know, this capacity reduction factor is a big sort of fudge factor in the analysis. So you're much better off measuring the shape of the vessel.

If you do that and then run a finite model with realistic numbers, then you know, maybe there's margin there, but we're not going to know, and even if you run an analysis and you do find margin, the next thing to do is then reduce the numbers on a generalized basis by some amount to try to come up with an allowance for corrosion to the next outage.

I mean, it's not good to show that as of today this drywell meets the code. You want to say even if we assume a reasonable worst case corrosion rate, and we assume that they're not going to look at it for another two years or four years or however long they're going to look at it for, and it's still going to meet margin during that period.

And actually Sandia, to be fair, did add in that kind of margin for the upper areas, but not for the sand bed.

So, you know, I guess I'm flogging a dead horse here, but corrosion made one, nine, 11, and 13 is widespread, and there are many points that are capable. Full grids show, in Bays 11, 17 and 19, show an average thinner than 844. In Bay 13, the best estimate of the area with an average thickness, thinner than .736, is around four square foot. The area thinner than .736 is probably expanded since 1992, and there's a high degree of uncertainty about the nature of the corroded surface. What I mean is the physical nature. How thick is it and what are the extents of the thin areas?

So even if the margin is .04, which is what you logically get from original plain thickness of .064 minus .02, the operator can't maintain that margin.

We don't have a worst case interior corrosion rate. The worst case exterior sand bed corrosion rate was .04 inches per year, and we know that the individual measurements have at least .02 inches random error. Some additional location error and probe rotation error, all those kind of things, and then there's possible additional systematic error which hasn't been well controlled for. I have to say that before I got involved with this case, I would have liked to have imagined that people who ran nuclear power plants, you know, routinely control for systematic error in critical measurements. I guess I've been disabused of that notion, but I think it's something they should start doing.

So the sum total of that is if you have a corrosion rate of -- if you combined interior-exterior corrosion rate of .04 inches a year, then you could run through your margin in a year. So I don't quite understand how the applicant -- you know, I've never understood this. How do they come up with inspection? If the coating fails and the commissions are wet, then they can start to see corrosion happening quite quickly, and the problem is that as we pointed out before, the measures to analyze whether it's wet and whether the coating fails are not very good. The coating failure inspection is once every ten year. So there's ten years there where, you know, you could fail and you wouldn't know that.

The water commitments likewise are unsatisfactory. We're talking about looking at the drains. It turns out in August of last year, the applicant tried to implement the commitment it had to check the drains and still failed to properly note what the content of the bottles was. They had to check it again to find out that really there was nothing in those bottles.

So we haven't seen an applicant that is particularly dept at implementing these commitments, and as I say, we've highlighted in our letter another possible problem of another commitment in the torus region. So we think it's a highly -- well, it's dangerous to just rely on a single commitment like whether somebody goes down there and looks for water. They haven't done it in the past, and it would be much better to have logging instruments that actually check for water.

According to our expert such instruments exist. We've seen no contrary claims that they don't exist or that they couldn't work down there. So it's hard for us to understand why they wouldn't want to do that.

Likewise the source of the water, we know that. It's hard for us to understand why the applicant hasn't looked to carry off the source of the water. It seems to me an obvious idea.

Now, just to reinforce the point about accuracy, here's an E-mail that we found. You know, I have a hard time fully interpreting this language. I guess I'll just read it. It says the equipment used in the past to perform, quote, randomly selected locations did not function worth a shit or it didn't perform to expectation, but it says because the locations were not stamped or date match marked. It wouldn't be possible to provide accurate follow-up inspections, and it ends by saying if you wanted to perform baseline inspections now. This was on October 10th, 2006, Mr. Ryan to Mr. Polaski.

Now, I fully understand which occasions they're talking about missing now, but what I do know is that it tends to indicate to me that the random error and even this systematic error may be somewhat higher which the application is missing a little.

Okay. Let's move on to the imbedded region. Now, what we know is is, as we said, the floor -- I think we went over this the last time. The floor had serious problems when they removed the sand. I guess we'll never really know whether the floor actually was constructed that way or whether it became that way due to corrosion.

What we do know is that with this plant we keep seeing repeatedly problems where the plant wasn't constructed according to specification. There's this problem, and apparently actually the stainless steel liner of the pool, the cavity pool was likewise thinner than it was supposed to be which is maybe one of the reasons why it has such extensive cracking, and likewise apparently the construction of the spent fuel pool floor was supposed to be keyed in with L-shaped rebar for the walls and wasn't. Where they had looked at that it wasn't found that way.

So it is at least plausible or at least possible that, indeed, tit was constructed improperly, but I don't think that's a particularly comforting explanation because it just gives rise to the question of what else was not constructed improperly. Well, what else was constructed improperly?

And it certainly means that you can't look at these drawings and just say, oh, well, this is what the drawings say. So it must be okay. In this case it's really a question of trust, not verify.

So as we know, that floor was repaired with epoxy in '92. Now, what we know is that we know there's a document from AmerGen that says that since 1996 inspections have found indications that epoxy is separating from the concrete, and the separate seams could potentially louse up water to get under the epoxy coating repair.

So I have a couple of questions about that. One is, well, you know, you'd think if it was important to stop water going down into the imbedded region that you might want to repair the floor when the inspections show that it's cracked.

Apparently that wasn't done. The next part of the document says that the separation could be caused by concrete swelling. Well, that's an interesting notation. I mean there's obviously something causing this cracking. If the concrete is swelling, I mean, you'd rather like to know about it. There must be something causing the concrete to swell.

Again, I don't know. I'm just quoting these documents, but I think it's something that if I was the applicant I might want to look into. We actually now know the bottom of the drywell is below the groundwater table which came up last time. Again, this is an AmerGen assessment.

And now in terms of what can you do to have a look at this region, which was a question that came up last time, apparently at Dresden they drilled holes in the concrete floor to take UT measurements, and in the SER the staff said that you could get a semi-quantitative assessment of this region using guided way technology and then kind of using the sort of logic which seems to pertain in these kind of documents, they say, well, since this wouldn't be a precisely quantitative estimate, it's hardly worth doing at all.

Now, I suggest to you that where a precise estimate is hard to make, it's at least a good idea to make a semi-quantitative estimate. If that semi-quantitative estimate comes up as a problem, then you can move on and try to figure out how to do a more quantitative estimate.

So the justification in the SER for not using guided way technology I don't think is logical. So I don't know if any of the NRC staff members want to address why they decided that was a bad idea.

So the imbedded region measurements, I said they were taken in Bay 5, and if you look at it, Bay 5 was actually the bay with the least corrosion. If you turn to Slide 54 of the AmerGen presentation you see that actually, I mean, kind of surprisingly, given the protestations of the consultant regarding the noncorrosive qualities of the water, what you find is that the corrosion in the san bed region in Bay 5 is not that different than the corrosion in the imbedded region.

There seems to be some confusion about why was Bay 5 selected. I suspect Bay 5 was selected because it had the most water in it from the inside. The problem is it's not the bounding. We don't really know much about what water is in the other bay. So I think the idea of bounding on the inside is probably not right. It seems to be rouse than Bay 17, but that's as much as you can say, but from the outside, Bay 5 is clearly the best bay.

So if you're trying to look for imbedded region corrosion, Bay 5 is absolutely the wrong place to look, and looking at this table you see that. I suggest, you know, Bay 1, Bay 13, Bay 11. All of those have serious corrosion in the san bed. Those are the regions you would want to look at.

We do know and the one thing we are showing is that corrosion is occurring, and if you look at the grid, I mean, it's hard to say how much because the nominal is 1.154. You can see in the grid above people give Slide 54. They make it 1.185. so it's hard to say exactly how much it is, but it seems to be something, and I haven't really had time to consult with my expert and trying to figure out exactly how much and what significance that has, but certainly these are issues that have to be fixed, have to be resolved before this thing can move ahead.

I mean, it's kind of amazing to me that we're in this position, that we're still debating these fundamental things at this very late hour and even when the staff -- I don't know how. This will be a mystery to me -- I don't know how the staff has signed off on this on the basis of this one measurement because this one measurement is absolutely not bounding.

Probably the best -- if you were trying to find a measurement that might come out good, this would be the one for you.

Conclusion. I mean, the basic conclusions, there's a significant probability that there's no margin in the sand bed region. We really don't know what the margin is in the imbedded region. Even if the margin is .04, which is pretty much what you end up concluding is the best case, it's too small to maintain the uncertainty in the measurements in the corrosion rates.

And here we should err on the side of

caution. Where does all of this uncertainty come from? All of this uncertainty has come from the applicant's inability to maintain a reasonable program both in time and space measuring the thickness of this vessel. You know, it was up to the applicant to make the case. They had to figure this stuff out and take enough measurements so that then uncertainties would be small enough so that they could convince you that they could have margin and they could maintain it.

So far I don't think they've done that. I worked for one of you, and I don't think you've done that. I'd like to ask or field questions now.

CHAIRMAN MAYNARD: Does anybody have any questions for Mr. Webster?

DR. WALLIS: I'm wondering who should respond to Mr. Webster. I mean, he has made a lot of assertions, a lot of statements about what the staff or AmerGen has done. I'm sure that we are the appropriate people to respond to all of those statements he has made.

CHAIRMAN MAYNARD: Okay. We're here to gather information, not to answer questions.

DR. WALLIS: That's right.

CHAIRMAN MAYNARD: Mr. Webster or Mr. Gunter's avenue to get questions answered would actually be through the NRC, through the staff, and again, that's not ours to answer questions. I think if they have specific questions, it's through the staff because the licensee also does not have to answer in this part of the regulatory process to them.

So their questions would be directed to the staff to answer. What is important is for us to get this information and for us to factor this in with all the other information that we have in our overall deliberations.

DR. WALLIS: Some of our deliberations could be based on the staff's replies to Mr. Webster. I mean, is the staff going to reply in some way to this or just leave it the way it is.

MS. LUND: I guess my question would be whether this is going to be submitted to us for answers. I mean, it's similar to what has happened in the past. We have a process for people to send, you know, comments and also letters and we respond to those all the time. So, I mean, I guess that would be my question, is whether it would be put into the process that we normally use to respond to questions.

MR. WEBSTER: Can I just make a couple of remarks?

One is that actually after the last ACRS meeting I made a specific query to the staff about a particular issue and subsequently after the end of the meeting I made a similar query to another member of staff, and so far have no response from those queries. So my ability to get answers from the staff is somewhat limited.

Second of all, we have a transcript here. I'd be more than happy to send the staff a transcript, but I think you get a transcript already. So if you could regard the transcript as a submission of those questions, I'd be obliged.

DR. WALLIS: Maybe you should itemize your questions. You have a question about what's the appropriate area to use for the thinned region when making a --

MR. WEBSTER: Well, that is actually the question I had asked.

DR. WALLIS: -- defined element study, and this seems to be a very straightforward, technical question, and if you're maintaining that the area should be bigger than was used by somebody, then that would seem to be a technical question that could be answered. I don't think it's something that we can answer.

MR. WEBSTER: That is the very question

that I asked actually, is (a) what is the staff's assessment of the current area that was thinner than .736. What is the basis of that assessment and what is the uncertainty of that assessment?

I'm still awaiting an answer to that question. I think that has been about three months I've been waiting for that answer.

MS. LUND: Yes, I think we'll take a look at the transcript and reply to that. We'll do what we do, send the answers similar to what we did I think it was for Palisades, send the response back.

DR. WALLIS: How long will that take?

MS. LUND: I guess I'd have to look at the number of questions and see, you know, how soon we can get responses from the technical staff.

DR. WALLIS: Quite an awful lot of questions.

MS. LUND: I guess that's my point, is that, you know, we need to look at the amount of questions from the transcript and also see how --

CHAIRMAN MAYNARD: And, you know, you'll have to take a look at the process and the right process. I think that by the time the transcript gets issued and we go through it, it may take longer than what time is available. I'll leave that up to you guys to address on how you submit or how you get the answers here.

As far as for the members, we do have access to the data. We have access to a lot of the information that he has shown bits and pieces of. I think part of our job is to take a look at that and take a look at the other data that we've got and see what conclusions that we may draw from that, too.

MR. SIEBER: One of the things we don't have is the slides from this section, or do we?

CHAIRMAN MAYNARD: We do have the slides, yes.

MR. SIEBER: Okay.

CHAIRMAN MAYNARD: We do have that.

DR. WALLIS: Mr. Chairman, we're supposed to analyze this. How much time do we have?

MR. WEBSTER: Well, there's also the letter that I sent as well, to add to your burden. I'm sorry about that.

MR. SIEBER: Two weeks.

CHAIRMAN MAYNARD: Yes, this is currently scheduled for the February full committee meeting. Also I believe that part of it is our obligation, too, that having taking input from Mr. Webster, we've heard from the licensee. We've heard from the staff. We've got a lot of information. If we need more information from the staff or somebody --

MR. SIEBER: Good luck.

CHAIRMAN MAYNARD: -- we should be able to question that.

DR. WALLIS: Well, we have other items to consider for the next meeting, too which require due consideration.

MS. LUND: And also we were just mentioning that the staff -- I was just asking the rest of the staff -- we don't have a copy of the letter that he's speaking to. I think he gave it to the ACRS members, but not to us.

MR. WEBSTER: I can certainly provide you with a copy. You know, I remind you last time there were serious questions outstanding and it was postponed from the full committee meeting. I think that's another cause for action from the members here.

CHAIRMAN MAYNARD: Okay. Are there any other questions for Mr. Webster or Mr. Gunter?

Okay. What I'd like to do right now is to exercise my privilege as Chairman. We're going to take a short, ten minute break, and then we'll come back and we'll have a round table discussion. I'll go around and ask the members for any thoughts.

One of the things we need to be identifying is what specific information may be needed in the full committee presentation so that we can provide guidance to the staff and licensee on things that we want to specifically have in that.

We will not have as much time, and so we will need to focus on key areas.

So with that, let's take a ten minute break. Actually we'll come back at five o'clock and we'll do our round table discussion. That's closer to 12 minutes.

(Whereupon, the foregoing matter went off the record at 4:49 p.m. and went back on the record at 5:04 p.m.)

CHAIRMAN MAYNARD: All right. I'd like to bring the meeting back into session.

I'd like to just start briefly by saying I appreciate everyone's participation. We've had a lot of discussion today, had input from the licensee, had it from the NRC staff, had it from members of the public, and that's something for us to all take into account, think about.

We'll have another meeting on this subject at our full committee meeting, and so we'll have some time to look over this and maybe -- I don't know --

generate more questions of our own and we'll see where things go.

What I'd like to do now is to go around the table, get any thoughts that the members have and, again, one of the things is if there's any specific areas that they think we need to cover in the full committee meeting specifically, like the one that we talked about, we need to identify that so that the staff and the licensee can be prepared to address that.

So I'd like to start with Mario and just what comments you may have or discussion items.

DR. BONACA: My first comment is that we have a large amount of data. I certainly would want to review them before the full meeting just to digest some of the information

A couple of general comments I have. One, clearly we have been presented with an assertion that the corrosion has been stopped and then that the drywell, therefore, can operate until 2029. I have to reflect more about the inspections of the monitoring program that they're proposing, whether or not I think it's adequate.

At first glance I think that I would like to see certainly a more aggressive inspection program in the short term, and I'm not sure about looking at it now and then in ten years doing inspections again.

So, I mean, the monitoring program is something I'll pay attention to, and I would like to see discussed definitely at the full committee meeting.

I have raised a number of times the issue of controlling sources of water. I mean, they may have done as much as they can to do that, but still during the refueling they have one gpm, water that comes down and will go down to the trough, and I'm sure of that.

But the question is have we done enough to control sources of water to assure that there is no further accumulation.

The other thing that, you know, is more like the issue of how the epoxy is doing, I mean, is there any corrosion taking place behind the epoxy? I don't know if the UT they're planning to do is going to tell us or is sufficient. I mean, maybe there should be some poking in some location to see if there is some weakness behind that.

But any, my attention is more focused on these programs that will give us some more comfort regarding the condition of the drywell and the ability to go for additional 20 years.

Those are my comments.

CHAIRMAN MAYNARD: All right. Bill.

MR. SHACK: Well, the surprise for me today was the notion that we have water in the imbedded region. That concerns me a little bit. I mean, I fully agree with the argument that it's a fairly benign environment and the corrosion rates are low, and in a containment that didn't have the already substantial corrosion that this one does, I would sort of agree that its probably not a problem.

But this is a containment where there isn't a whole lot of margin, and you know, the estimate was you had 41 mils lost and that was less than one mil per year. Well, I do the arithmetic and I get more like tow mils per year, and you do have data on these 106 points.

Many of them are down in the region where you are looking through the thing at the imbedded region, and I think there's some data there that one could look at to try to really see just what you think the corrosion rates are in that imbedded area and understand that a little better.

I'm fairly comfortable with the notion that if the epoxy coating is in good condition, that the corrosion on the OD is arrested, and that the visual examination is a good thing there. I'm a little less convinced with the small margins that we have that the corrosion in the imbedded region is as negligible.

Again, the buckling analysis, again, I think that we have to settle on both the legalistic requirements of who's analysis that you can accept, but it seems to me that perhaps it is time to take a more realistic -- you know, you haven't got enough margin to do the uniform thinning model anymore.

The Sandia one does seem to indicate that you have enough left. It makes it more difficult to assess just how much margin you have because it's difficult, but again, I'd like to hear more discussion over the kind of credit that should be given. Since there is no internal pressure, you know, whether the circumferential tension really does give you credit that you can account for, whether it's already built into the IGAN value analysis that you get out of the finite element model. I'm not 100 percent convinced that I'm not double counting here. You know, some more discussion of that would be helpful to me.

DR. BONACA: Yes, I had another comment I forgot to mention which was one of the assumed thinner areas of one square foot. It would have been interesting to know how large an area you could tolerate, but that's a question I believe Sam raised, and I'm behind that.

CHAIRMAN MAYNARD: Okay. Dr. Wallis.

DR. WALLIS: Well, I think we got a lot more information than we got last time. I think that a lot of people made considerable effort to present things professionally.

The question for me is this buckling analysis and how good does it have to be. We got close enough to it could be a condition where you wouldn't accept the results. Do we have to -- I have to look at these things again in some detail to see whether I'm satisfied or whether I want to maybe even ask for some more analysis.

I think the buckling analysis is the most important issue here, and I'm not really sure whether it's adequate or not yet.

CHAIRMAN MAYNARD: Sam.

MR. ARMIJO: Okay. I was impressed, and I'd like to thank AmerGen and everybody who put this package together. It was exactly what we asked for. As far as the information, it was well presented, easy to read and that was very good.

I think the issue, first of all, from the 2006 inspection, I was impressed with the condition of the epoxy. It has been on there for 16 years, and I really was surprised what good shape it was in.

I think the issue of the UT measurements and all of that controversy could be sorted out by having a set of data, a curve, an analysis that shows as a function of area, affected area, percent of the sand bed region or some parameter that's area that goes from zero to 100 percent and the 100 percent thinning represents the general thinning issue, and at some point there will be a thickness that's acceptable at five percent of the area or square foot, you know, some parameters.

Because if it's one square foot, it could be paper thin. If it's four square feet it can be .256 square feet, et cetera. So some parametric analysis, I think that needs to be done.

DR. WALLIS: You're asking for more and more and more --

MR. ARMIJO: Yeah, I don't know if that's legal.

DR. WALLIS: -- buckling analysis, which I'm sort of tempted to do, too, but that's a lot more work for somebody.

MR. ARMIJO: Well, I don't know, but I think it needs to sort it out because we know it's a variable shell. There's a lot of variability, and so somewhere we're going to have to use the data. The licensee is going to have to use the data to describe that shell in a way that it can be analyzed and that we can accept, if we can.

I think the GE analysis, there's controversy about their capacity factor reduction. I think that should be reassessed by the licensee, whether it's still valid. They still believe that that's their submission. That's what they're going to stake their claim on.

My suspicion is that they haven't taken full credit for the conservatisms that they do have and that if there is a reanalysis or an update of that analysis, they should use the measured data, all the date, not just some arbitrary .736, but all the shell because that thing will not buckle if half of the shell is at .8 and the other half is at .95. I mean, you've got to use the entire thing.

And so I think there's some analysis that needs to be done. I'm not sure whether we need anymore data.

The last thing is I don't like to se

anymore water in or aroudn that containment that isn't there on purpose, and I would never cover up that trench personally. I'd monitor that. I don't know where that water is coming from. I think you've got to find it out and make that problem, that issue disappear.

And I share with Mario the concern that I don't know why AmerGen wants to continue living with a potential of having a leakage occur from that cavity liner. I would think that there ought to be a rethinking about fixing that, finding some practical way to repair that so that leakage just stops.

To me that would be fix the source and then you don't have to worry about the containment. Those are the kinds of things that are bothering me. So I'd like those issue raised, really, the status of the GE thing, the issue of acceptable thickness versus affected area, some sort of a presentation like that.

CHAIRMAN MAYNARD: Okay. Some of this, the analysis that you would like to see would not be possible or practical to reanalyze before our meeting. I think the may thing we probably need to do and maybe they can -- I don't know -- but they need to address these issues at the next meeting.

MR. ARMIJO: Right, and maybe they can't

analyze it, but I just think that's what needs to be done.

CHAIRMAN MAYNARD: Okay. Said.

DR. ABDEL-KHALIK: I agree with all the comments made by my colleagues. I would like to reiterate that my primary concern pertains to the analysis of record submitted by the applicant and whether it conforms to ASME code requirements specifically as it relates to the modification of the capacity reduction factors and the buckling analysis of the refueling case.

I'd like to point out that GE pie section, 36 degree analysis, Mode 1 buckling result corresponds to a Mode 10 buckling result for a 360 degree calculation, and therefore, one cannot expect that result to adequately model the entire behavior of the shell specifically if the lower modes are much more limiting than the higher modes.

Again, like my colleagues, I was sort of surprised about the discovery of water between the concrete floor inside the drywell and the inside surface of the drywell, and I agree with Sam that I think it would be a good idea not to cover that trench and just make sure we monitor that and find out where that water is from and how much of it is there.

MR. ARMIJO: I wanted to add one thing. I'm not so worried about the imbedded region and perhaps the licensee wants to think about a simple analysis of the potential for buckling when you have a highly constrained junk of metal between two big concrete blocks. My guess is --

MR. SHACK: No, no. But there's a portion of that where you've got the imbedded region and the free region. Once it's fully imbedded --

MR. ARMIJO: At that interface between the sand bed and the imbedded regions is probably the area of concern, but once you get substantial concrete on both sides, I don't know what the problem is. But you know, there shouldn't be water on the inside of it.

CHAIRMAN MAYNARD: Anything else Said?

DR. ABDEL-KHALIK: That's it. Thank you.

CHAIRMAN MAYNARD: Jack.

MR. SIEBER: I differ with my colleagues on what ought to be done with the little trench that runs around on the inside. I would like to keep the water away from the steel, and so I'd fill in the trench and put the curb back because it's inaccessible. You can't run in and out of there during operations, and so the only time you get to look at it is during refueling outages.

MR. ARMIJO: If you dry it Jack and make sure the water doesn't get there some other way, I totally agree with you.

MR. SIEBER: Well, let me point out that that plant like a lot of plants was built so that the drips and drains go on the floor, and they did not put drain lines in and all kinds of things that direct them directly to the sump. It goes to the floor first. And as the floor slopes or catches up against the liner, I just don't think it's a good idea to have water up against that liner. So I would protect it.

As my second comment I made a comment during our last meeting about the seismic spectral response of the containment with and without the sand in the sand bed region, and how GE's analysis dealt with that.

And I've learned during this meeting that the constriction of the sand bed was not considered in either analysis, and so the physical removal of the sand bed makes no difference in the analysis. And so as far as I'm concerned, that issue is resolved.

We had a fair amount of discussion, and I think there is at least in my own mind some confusion about the differences between the Sandia model and the General Electric models. I think they use different techniques with different scales. They ended up with different results, and one of the things when you look at a pressure vessel with a complex shape like the drywell is and it has different thicknesses, you've got different acceptance criteria depending on where you are.

That needs to be clearly defined and justified and the basis provided for that based on one model and not say, "Well, if I use this model, it's this, and if I use that one it's that." To me that's disturbing.

I come away with an element of confusion, and I don't consider that resolved at all until we come out with a definitive set of criteria that says this is the analysis of record. These are the criteria that are used, and I would like to see a later technique than the General Electric technique because I think modeling the whole thing with a finer mesh in a more modern computer is a better technique.

And then after that occurs, then I think there has to be a reassemblage of the data in consideration with some of the things the ASME code says. The ASME code is not a simple code, and it allows one to take certain exceptions at places where the cross-sectional area of the member changes dimension, and so forth, and differences between elastic and plastic deformation, and that needs to be figured into the acceptance criteria so that even the simple person like I am can interpret it and come out with the same result every time and my brother can do the same thing and come out with the same answer.

DR. WALLIS: Could I add to that?

I'm not sure that the ASME code really covers this complicated a situation.

MR. SIEBER: I think it requires some interpretation. On the other hand, the ASME code refers to the governing authority. All of the codes do, which happens to be this agency.

So the interpretation of the code and the application of it to a specific example like this situation is the agency's responsibility to make.

On the other hand, they just can't flippantly do it. They have to write it down and provide the basis for what it is they're doing and why that's the way that it should be interpreted. I think that those kinds of loose ends need to be tied up in order for me to feel comfortable enough with all that has happened here.

Other than the issues with this containment, I don't see other issues in the plant that would prevent the license renewal, but I think there's plenty to chew on here with the containment. And I think answers can be found to the questions that I have, and I think they are parallel to a lot of other people's concerns. I think they ought to be addressed. I think mine can be addressed sine it's a matter of explanation by the full committee meeting.

CHAIRMAN MAYNARD: Okay. Thank you, Jack.

I'd like to compliment all of the presenters. Again, I think it has been a long day, a lot of good information provided. I believe that the licensee was very responsive to our questions from the last meeting and issues and concerns that we had with their presentation provided use a lot of good information with good additional information always comes good additional questions on our part, but I think that's healthy for the overall process.

The NRC staff, their inspections, I was impressed that the inspectors actually went into some of these areas so that they could see for themselves. These are not easy areas to get into, and again, I think that shows that the staff was wanting to see for themselves what the condition of the epoxy and stuff was.

And also the public comments, again, I

believe have raised a number of questions and gives me something to look at and taking some additional looks at the data and perhaps generate some additional questions for the staff or for the licensee.

Again, I think everyone did a good job. Personally, I'm not bothered by some of the differences between the GE and the Sandia analysis. I think it's good to approach some things from different ways. I think they both show that there's additional conservatisms that are still in both of the analyses. They're still very conservative analyses.

I do think we still have a question to resolve as everybody else. We need to resolve whether the GE analysis that took the capacity adjustments into account. Is that legal? Is that appropriate and find out, you know, from the licensee and from the staff as to whether that's acceptable because that does make a difference in what you use as what your base is for your margin and for measuring things.

So I think that that is something that definitely needs to be addressed and taken care of.

My last area and probably one of my primary ones, I am still concerned with continuing to find water and living with some leakage there, and I understand the discussions and the arguments on how it can be managed and everything, but the reality is we're supposed to be keeping water out that we don't intend to get there, and I think there needs to be some further discussion, and I still have some questions and concerns as to whether enough is being done in that area with the water.

And as far as the trenches, I believe that the trenches should be left open until we are sure that we don't have any water. I think it's good to have them open. I think the licensee committed to make sure the water was gone before they filled it in, but I do think that eventually it is the right thing to do to fill those in, but I think initially they do need to be kept open for the monitoring and they're there to see that we're not getting any surprises and stuff there.

but I agree with Jack. I think in the long term -- maybe Jack would do it quicker than I would, but I think we both would like to see those covered at some point and prevent water from getting into there.

But anyway, those are my comments. I'd like to thank everyone for their participation today. I hope that the staff and the licensee have from our comments some ideas of some of the things we will be --

DR. WALLIS: Can I raise a question now?

CHAIRMAN MAYNARD: yes.

DR. WALLIS: I guess this has to go to the full committee. Sometimes a subcommittee can say that there are big enough doubts that something needs to be worked out before we go to the full committee. We are on schedule. We have to go to the full committee at the next meeting. Is that the case?

DR. BONACA: My suggestion was that if we go to the full committee meeting, I think that all the other aspects of license renewal are pretty much in line with other applications. I think I would focus the whole meeting on the two analyses.

DR. WALLIS: I am just wondering can we resolve some of these buckling questions by the time of the full committee meeting. I'm not sure we can.

DR. BONACA: You may be right.

CHAIRMAN MAYNARD: I guess feedback from the table as to whether -- and I haven't been involved in some of these in the past. I don't know if it's best to delay it until we get all of those questions or is it best to take it to the full committee. If the questions are still unresolved, do we have another meeting there and do we write an -- I'm not exactly sure what the process is at that point.

MR. SIEBER: Well, I don't think the subcommittee can do that on its own.

DR. WALLIS: We have in the past sometimes, but I think in this case --

MR. SIEBER: I think it should go to the PMP.

DR. WALLIS: There's enough meat here that we probably should go to the full committee.

CHAIRMAN MAYNARD: I believe it's important at this state. My opinion would be take it to the full committee and then based on what additional discussions there, based on the full committee input, determine what our next step would be.

MR. SIEBER: I think that's wise.

CHAIRMAN MAYNARD: Any other comments, questions?

(No response.)

CHAIRMAN MAYNARD: All right. The meeting is adjourned.

(Whereupon, at 5:31 p.m., the meeting in the above-entitled matter was concluded.)