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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

January 18, 2007

The contents of this transcript of the proceeding of the United States Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, taken on January 18, 2007, as reported herein, is a record of the discussions recorded at the meeting held on the above date.

This transcript has not been reviewed, corrected and edited and it may contain inaccuracies.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

SUBCOMMITTEE ON PLANT LICENSE RENEWAL

OYSTER CREEK GENERATING STATION

+ + + + +

THURSDAY,

JANUARY 18, 2007

+ + + + +

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.

MEMBERS PRESENT:

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

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 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

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.