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NUCLEAR REGULATORY COMMISSION

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565TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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FRIDAY,

SEPTEMBER 11, 2009

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ROCKVILLE, MARYLAND

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The Advisory Committee convened at 8:30 a.m. at the Nuclear Regulatory Commission, One White Flint North, Commissioner's Conference Room, 11555 Rockville Pike, Dr. Mario V. Bonaca, Chairman, presiding.

COMMITTEE MEMBERS:

MARIO V. BONACA, Chairman

SAID ABDEL-KHALIK, Vice Chairman

GEORGE E. APOSTOLAKIS, Member

J. SAM ARMIJO, Member-at-Large

SANJOY BANERJEE, Member

DENNIS C. BLEY, Member

CHARLES H. BROWN, Member

COMMITTEE MEMBERS (CONT.)

MICHAEL L. CORRADINI, Member

OTTO L. MAYNARD, Member

DANA A. POWERS, Member

HAROLD B. RAY, Member

MICHAEL T. RYAN, Member

WILLIAM J. SHACK, Member

JOHN D. SIEBER, Member

JOHN W. STETKAR, Member

A G E N D A

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

(8:30 a.m.)

CHAIRMAN BONACA: Good morning. The meeting will now come to order. This is the second day of the 565^{th} Meeting of the Advisory Committee on Reactor Safeguards. During today's meeting, the Committee will consider the following, updated information related to the license renewal application and supplemental SER for the Beaver Valley Power Station, Subcommittee reports, future ACRS activities, report of the Planning and Procedure Subcommittee, reconciliation of ACRS comments and recommendations, preparation of ACRS reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Mr. Tony Santos is the Designated Federal Official for the initial portion of the meeting. We have received no written comment from members of the public regarding today's session.

Region I Staff and several personnel will be on the phone bridge line to listen to the discussion regarding Beaver Valley. We have received a request from Mr. Paul Gunter, Beyond Nuclear, for time to make oral statements regarding Beaver Valley license renewal application.

A transcript of a portion of the meeting is being kept, and it is requested that the speakers use the microphones, identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

Before we proceed with the first item on the agenda, I would like to remind you that all of you have been provided with copies of the papers for the meeting in Japan, Working Group. There are five papers, and you are welcome to provide comments to the authors, as soon as possible, I would say, because they have to be finalized by the middle of the month. We are almost there. And I'm sure that both Charlie and Dana will be anxiously waiting for those papers.

MEMBER BROWN: We will entertain no comments, also.

CHAIRMAN BONACA: All right. With that -

MEMBER SHACK: Can the ACRS Staff send us an electronic version of those?

CHAIRMAN BONACA: They could do that.

(Off the record comments.)

CHAIRMAN BONACA: With that, we will move to the first item on the agenda, and that's the updated information related to the license renewal application and supplemental SER for the Beaver Valley

Power Station. And Dr. Bley will take us through the presentation.

MEMBER BLEY: Thank you, Mr. Chairman. The Committee met with First Energy and with the NRC Staff on the subject of license renewal application for Beaver Valley Power Station Units 1 and 2, and the Staff's Safety Evaluation Report on that application during our last meeting on July 8th of this year.

I will not reiterate the specifics of the plant designs, or the issues discussed, except to say that one issue of significant concern was through-wall corrosion of the Unit 1 containment liner that was discovered in April of 2009. Following the meeting, and before our report was finalized, the applicant submitted new information clarifying and expanding the documentation of its plans for the supplemental volumetric examinations of the Beaver Valley containment liners.

The Committee agreed to hold the release of our letter until after this briefing to allow us to address factual changes that we might want to reflect in our letter. At this point, I'll turn it over to Mr. Brian Holian of the NRR Staff.

MR. HOLIAN: Good morning, ACRS and Chairman. Thank you. My name is Brian Holian. I'm the Director of the Division of License Renewal. The agenda for today has me doing brief introductions, opening statement, and then turn it over to licensee for their presentation, followed by the NRC Staff presentation. I'll hold off on the NRC Staff presentations until they take their turn at the table after the licensee.

Just a few brief comments. We do appreciate the opportunity to revisit this issue following the last meeting. I think there some good questions raised at the last meeting, various questions on the timing of UT inspections. There was a question about the randomness of the UT inspections, smart sampling.

On that point, in particular, I'd like to credit an interested stakeholder group that had written the ACRS a letter right prior to that meeting, and they had been following Staff discussions that are with the licensee on that aspect. And just shortly on that, and we'll get into it more later, the Staff was looking at the importance of random samples for the 95 percent confidence that we'll discuss more today, both the Applicant and us, but also smart samples for what is the root cause, and could there be other areas that are more prevalent for that?

So, we appreciate the opportunity to straighten out both of those examples that we think are important, to have samples of both.

There were other questions raised that both the Applicant and the Staff will discuss today, Appendix J testing, how that relates, what confidence that gives you. And we've used the time wisely since the last meeting, also, to clarify with the Applicant via a couple of letters, the criteria that they'll have in place for when they do the UT samples, what their failure criteria will be as they take those samples, to kind of smartly look at our trend what the condition of the liner is, or confirm its condition.

One other item that's been brought up, and the Staff still has several letters to respond to for the interested stakeholder group. One other aspect you'll hear part of today in the Staff's presentation is, is a sub-atmospheric containment more prevalent for maybe moisture to be brought in from the outside through porous concrete towards the liner? You'll see today, both from the Applicant and the Staff, the operating experience is centered around construction material that appears to have been left, the cases that we have where the liner has gone through-wall. That's the major issue that we've seen. It doesn't mean we are necessarily ruling out any other potential cause. As a matter of fact, we're looking at having Research ourself with the NRC Staff do some confirmatory look at kind of the different containment designs, and we're still finalizing that.

One last item on my introductory comments. In the licensee's letters, and I know at least one member of the ACRS Staff asked me before the meeting, when their letters come in, they talk about regulatory commitments, and you will see that they revised some commitments from the last meeting, which is good. We continue to work with them. It solidifies the SER, and makes those public.

Somebody asked me about a sentence in the cover letter about regulatory commitments, there are no regulatory commitments in this letter. That's more of a legal term, since some of the commitments aren't legally enforced until the period of extended operation starts. But the commitments were placed in the SER, and Commitment Table by the Applicant, and I wanted to straighten that point out.

With that, I'll turn it over to the Vice President of Beaver Valley Station, Mr. Peter Sena.

MR. SENA: Thank you, Brian. Mr. Chairman, members of the ACRS, again, good morning.

I'm Pete Sena, Site Vice President, Beaver Valley. Again, we do appreciate the opportunity this morning to discuss with you our issues with respect to the Unit 1 containment liner, and the associated corrosion that we identified.

Again, as you know, our liner is part of an integrated containment system which undergoes vigorous testing in accordance with industry codes and standards. It is through that inspection plan that we did identify corrosion of our liner, absolutely. We found a problem. As you know, this is a localized pitting corrosion due to foreign material. This foreign material that we identified was from initial construction. This is very similar to corrosion identified at other nuclear facilities throughout the industry.

We at Beaver Valley take very seriously our responsibility towards safe and reliable operation of the units. Currently, there are four plants in the United States with an INPO Index of 100. Beaver Valley Unit 1 is one of those four plants. But even though our performance has been very good, we just guard against complacency. It's too easy to say it's good enough.

As we went through our decisionmaking, and our actions with respect to the containment liner, and our going forward inspection plans, we would always go back and reference this document. It is something I carry around with me at all times. It's very worn, dog-eared; it's the INPO document on the principles for a strong nuclear safety culture. Principle Number Five states, nuclear technology is recognized as special and unique. The special characteristics of nuclear technology are taken into account in all decisions and actions. Specific attribute discusses, and I quote, special attention is placed on maintaining fission product barriers and defense-in-depth. We absolutely agree; we need to do more. That is not an issue.

We believe that the actions we've taken with working through the NRC, and looking at industry OE, that our actions are prudent, and proactive in insuring that our containment liner maintained in a reasonable state of operability throughout the period of extended operation.

This morning, our discussion will focus on the safety significance of the corrosion, we'll discuss our dose assessments, our safety analysis, and we will provide detail on our future examination plans, and the timeliness of such actions. With that, I'd like to turn it over to Cliff Custer.

MR. CUSTER: Good morning. Thank you, Pete. You've already heard from Peter, Site Vice President. With me today to my right is Mark Manoleras, the Site Engineering Director. Along with him to the right is David Grabski, the ISI program owner. I have several site subject matter experts, and members of the LRA core team with me today. I will take a moment just for the record to introduce them.

Carmen Mancuso, who is the Manager of Design Engineering, Dave Price, Design Engineering Supervisor for Mechanical Structural, Ken Frederick, Lead Safety Analysis Engineer, Tom Westbrook, Staff Engineer Structural Design Engineer, Bill Etzel, our lead PRA Engineer, Jack Patterson, Containment System Engineer, David Jenkins, our FENOC Legal Counsel, Kathryn Sutton from Morgan Lewis representing FENOC, Dr. Gary Harlow, Chair of Mechanical Engineering Department at Lehigh University, representing FENOC, Dr. Larry Core from Westinghouse helping us in representing FENOC, Clark Mickhoff, also from Westinghouse. Those are the members that we brought with us today in order to address any questions that the Committee may have.

Our agenda today I want to go through is go through the history of the containment liner at Beaver Valley. We'll review the safety significance. We'll hear from Ken Frederick. We'll review our examination plan, and we'll finish -- Mark will finish in reviewing the conclusions.

As discussed in the prior ACRS meetings, our Unit 1 containment liner history in 2006, we identified degradation on the concrete side of the liner during the steam generator replacement project. Three areas of general pitting corrosion were identified. These were localized areas roughly one foot in size. Two of the three areas were replaced. The third area was evaluated and monitoring continues. At this time, we basically see no change in that area. Hydro demolition during preparation for the area destroyed the definitive evidence of the corrosion source.

Based on the defect characteristics, it could have been FME. We searched through the debris pile, and could not definitively find the FME.

MEMBER POWERS: What is FME?

MR. CUSTER: I'm sorry. Foreign Material. In 2009 -- thank you. Let me correct -- rather than use the acronym, Foreign Material. In 2009 at Unit 1, one indication was noted during the scheduled IWE visual inspection. It was noted as an in-tact paint blister. By our procedure at the time, that required further examination by VT-3 qualified individual. That examination then led to a volumetric examination of the area. Subsequent cleaning identified a one-inch by three-eights inch through-liner defect, the root cause of which was determined to be wood, low pH, the wood contained low pH, and had high moisture content. It was a two-by-four roughly six inches long. At that time, we repaired the defect, and performed a baseline volumetric examination.

At this time, I'd like to have Ken Frederick talk a little bit about the safety significance.

MEMBER ARMIJO: Before you do that, could you tell me what the deepest pits that you found in the 2006 examination, the three areas of pitting corrosion, how deep were those pits in comparison to the wall thickness of the liner?

MR. CUSTER: Yes. What I'd like to do, I'd like to have Dave Grabski, our ISI program owner, talk to that.

MEMBER BANERJEE: Also, do you have sort of a picture of what this looked like, and where the wood block was relative to it, just behind it, in contact with it?

MR. GRABSKI: Yes, I can speak to that. This is Dave Grabski, the ISI program owner. First of all, the deepest pits found in 2006, one area had small pitting as low as .151 wall that was remaining.

MEMBER POWERS: I have no idea what that meant.

MR. GRABSKI: Excuse me?

MEMBER POWERS: .151 of wall, what does that mean?

MR. GRABSKI: 0.151 inches left, the nominal is 375 wall, three-eighths inch. One thickness that we found is a pit of 0.151.

MEMBER ARMIJO: That's minimum thickness. I asked pit depth, so I subtract that from -

MR. GRABSKI: That's the remaining wall.

MEMBER ARMIJO: That's remaining wall, .151.

MR. SENA: Take that off of .37.

MEMBER ARMIJO: So, the pits were two-tenths of an inch out of .375. Is that correct?

MR. GRABSKI: That's the amount that was lost, if you subtract 151 from .375. And that was a very localized pit. The second area was at 0.225

measured thickness. That would be a loss of .150. Third area generally was at nominal thickness of the liner. However, there was a pit found at .330. These areas -- the area of corrosion was bounded by approximately one foot by one foot area on the liner itself.

MEMBER ARMIJO: And you left one area unrepaired, so you could monitor it. Have you actually done any measurement since that time?

MR. GRABSKI: Yes, we have. We committed to look at it once every 40 months for the next 10 years. And we've done one examination on that, and we found, essentially, it had not changed.

MEMBER ARMIJO: Changed in one exam. Okay.

MEMBER BANERJEE: So, these pits were on the side in contact with the -

MR. GRABSKI: These pits were in contact on the side of the liner that comes in contact with the concrete.

MEMBER BANERJEE: It would nice to be able to see what it looked -- is it possible?

MEMBER BLEY: We have a set of pictures we had at the last meeting, so we have them on file.

MEMBER ARMIJO: That was a picture of the wood, where the wood was in contact.

MEMBER BANERJEE: Contact with the concrete.

MEMBER BLEY: This isn't the place where the wood was.

MEMBER BANERJEE: This somewhere else.

MEMBER SHACK: Yes. Think of two sort of mechanisms of corrosion. One, this patchy kind of area of pitting, and then the localized through-wall with the wood.

MEMBER BLEY: Which was found this year, Sanjoy.

MR. SENA: Right. So, again, for clarity, the data that Mr. Grabski just presented were the three areas of pitting corrosion identified from the steam generator replacement outage from the 20 by 20 foot section of liner that was removed.

MEMBER BROWN: When you got this exposed to show the cross-section, is that where you ground away until you got down to the source? Is that how you came up with that?

MR. CUSTER: I believe the picture that you gentlemen are looking at is a 2009 event.

MEMBER BROWN: Yes.

MR. CUSTER: Okay. Dave, do you want to

talk about after we discovered it, how we pursued it with cleaning and so on?

MR. GRABSKI: Sure. Dave Grabski, again. Again, the paint blister was found during our IWE examination earlier this year in our outage procedure, that any time we have anomaly on our paints, we require an ASME 11 Code qualified examiner to go do a visual examination before they clean it. After that examination, we cleaned the paint off and found, basically, what you saw in that photo.

At that point, we took UT thickness measurements around the through-wall to determine how extensive the thinning was. We found that there was an area about approximately two by five around the hole that had degradation below nominal, so once you got out of that two by five area, it went right back to normal.

Basically, what we did after that is make the repair, and we cut out the portion of the liner. We saw behind this area, a two by four block of wood. We removed some of the concrete to get the entire piece of wood out. We found it was approximately six inch in length.

MEMBER BLEY: I would like to interrupt this at this point. We've only got about 15 more minutes for this presentation, and we haven't gotten to the new material. I think we need to move into that, not reiterating what we went through last time.

CHAIRMAN BONACA: Take the time that it takes.

MR. CUSTER: Okay. In the discussion that David just provided you, he said that the area of general degradation was two by five of the wall thinning. Keep in mind what we found from the foreign material was actually a piece of two by four, about six inches long. That's what we found behind the liner. And we are talking inches, two inches by five inches, not two feet by five feet, very important to clarify that for the record.

Okay. With that, moving forward. Ken, would you like to talk about our assessment of safety significance, please?

MR. FREDERICK: Good morning. My name is Ken Frederick. I'm a Lead Safety Analysis Engineer at Beaver Valley, and what we want to talk about now is the assessment of the significance of the liner defect in terms of the impact on possible dose results post-accident.

We did an assessment using some data that we obtained from another plant, which had a similar defect, and they actually did a pressure test to determine what the leakage through that defect would be. We took that data, and it was actually scaled based on the ratio of the defect areas between our plant and that other plant, and it was roughly a factor of seven difference in the areas. So, even though the leakage through that clearly is limited by the concrete, which is on the other side of the liner, we increased that leakage rate by that factor of seven as a conservative measure. Again, that leak rate was measured at the peak accident pressure.

We took that number for our plant and added it to our previous integrated leak rate test results to determine what the projected total leakage might have been, and compared that to our allowable limit of .1 percent per day. We found out that the projected leak rate was less than what was the limit, which basically meant that our bounding dose analysis were still current. In other words, the leakage did not exceed what we assumed in that dose analysis.

MEMBER RAY: Excuse me. How would you adjust, if at all, for a design-basis event affecting the leak rate?

MR. FREDERICK: Well, there is -- in terms of the measurement -

MEMBER RAY: No, I just mean take a seismic event, or something that -- the leak rate you're measuring, of course, doesn't represent accident conditions, it's just a leak rate measurement you're extrapolating from another plant. But the question is, in this case, it's easy enough I think for me and everybody else to say well, it wouldn't be -- the leak wouldn't be increased under accident conditions, like a seismic event, for example, because the corrosion is localized. I'm putting words in your mouth now. I'm trying to get you to say it. You conclude that the design-basis event wouldn't increase the leak rate. Is that correct?

MR. FREDERICK: That's correct. Yes.

MEMBER RAY: All right. But there are some circumstances that might not be the case. Would that be a fair statement?

MR. FREDERICK: I can't imagine anything that would change. I mean, we pressurize to the peak accident pressure when we do that leak rate test.

MEMBER RAY: But you don't -- you're not loading it with seismic forces, for example.

MR. FREDERICK: Correct. Yes, I wouldn't believe that -- the building is, obviously, designed to be seismic qualified, and post accident qualified for whatever pressure and temperature conditions exist.

MEMBER RAY: Okay. But, my only point, I guess we're in agreement that you can't -- without some analysis, you would have to show that the corrosion, or the degradation, whatever it is, isn't going to change the behavior of the structure under design-basis conditions. And, in this case, it's pretty easy to do, I would surmise, by inspection. But, nevertheless, that's something you have to add to just measuring the leak rate, isn't it?

MR. FREDERICK: If there was some known mechanism where it would increase under those conditions, yes, we would need to add that.

MEMBER RAY: Okay.

MEMBER ARMIJO: Well, the liner could tear. You've got a hole in it, a seismic event, how can you conclude that it's impossible for it to tear open more and leak more?

MR. MANOLERAS: This is Mark Manoleras. Ken may be able to show the margins that are available associated with the analysis, and then can also have some of our structural folks come up and talk about how we believe that would or would not propagate.

MEMBER ARMIJO: Okay.

MR. MANOLERAS: So, that may be most appropriate at this time, is for Ken to go through some of the analyses.

MEMBER SIEBER: I think you also have to keep in mind that a static leak rate test measurement is a conservative measure, because Beaver Valley, along with other sub-atmospheric containments has containment sprays, and the containments sprays actuate the pressure declines. In the original design of Beaver Valley, it was designed to return to atmospheric pressure inside containment on a design-basis accident within one hour, so any static leak rate test measurement that you make is highly conservative with respect to estimating your approach to Part 100 limits.

MR. FREDERICK: This is Ken Frederick. Very good lead-in, Mr. Sieber. Next slide, please.

MEMBER POWERS: But this is just a plausibility argument. The flow resistance is embodied in the concrete, which is not the concrete of this plant; it's the concrete of some unnamed but similar plant. Am I correct on that?

MR. FREDERICK: Yes. The plant that we got the test data from has virtually identical containment in terms of the thickness of the walls.

MEMBER POWERS: I mean, it is not transparently obvious to me that the leakage does exist identical, because the leakage is some random defect in the concrete.

MR. FREDERICK: Right. And we recognize that there is some uncertainty in the application of data, and that's why -

MEMBER POWERS: This is just a scoping analysis to find out if I'm in big trouble now or not, and you're not. Okay?

MR. FREDERICK: Right. And this slide kind of points to that. If you look at -

VICE CHAIRMAN ABDEL-KHALIK: Let me just ask you. Does your accident analysis keep track of the pressure in the annular gap between the liner and the concrete?

MR. FREDERICK: No, because, normally, there would be no path for that to pressurize.

VICE CHAIRMAN ABDEL-KHALIK: So, there is intimate contact. There is no sort of gap downstream, or on the outside surface.

MR. FREDERICK: Go ahead, Mark.

VICE CHAIRMAN ABDEL-KHALIK: Is that always the case?

MR. MANOLERAS: This is Mark Manoleras.

If you would, if we can let Ken please present the margins associated with the safety analysis, I believe that question will be answered, and then we can revisit that.

MR. FREDERICK: Okay. What this slide shows, basically, is the margin between what is the leakage value assumed in the dose analysis versus what we would actually expect under a normal post-accident pressure transient. If you look at the red line there, by regulation, Reg Guide 1.183, we're required to assume that for one day after the accident the leak rate is at the tech spec limit. And then for the following 29 days, it's one-half of that. So, if you look at the blue line, that's what we actually would expect it should look like based on -- essentially, this was generated by calculating the area associated with the leakage that we saw, or would project, and putting that into our containment analysis, and running a 30-day transient.

MEMBER CORRADINI: So, can you just repeat that? I didn't -- I got the red. What's the blue?

MR. FREDERICK: To get the blue, what I did was take the area associated with the leakage projection that we had, which was the ILRT plus the defect leak.

MEMBER CORRADINI: Oh, okay.

MR. FREDERICK: Take that area and put in our containment model, and run a pressure transient.

MEMBER CORRADINI: Okay. So, not to make matters worse, but I guess I want to make sure I separate the extrapolation from the whole -- if I had the liner with no concrete, where would that line lie?

MR. FREDERICK: The blue line?

MEMBER CORRADINI: No. Take your concrete -- take your extrapolation from some other containment, whatever its behavior, and if it was just a liner with that hole, where would it lie?

MR. FREDERICK: With no concrete.

MEMBER BANERJEE: With and without the hole.

MEMBER CORRADINI: With and without the hole.

MEMBER SHACK: Yes, you want to drill a hole all the way through the concrete equal to the area of the liner hole.

MEMBER CORRADINI: Forget the concrete.

MEMBER SHACK: It's a big hole.

MEMBER CORRADINI: Okay. That's what -- okay, fine. That's what I thought, I just want to make sure. This is, primarily, the resistance in the concrete.

MR. FREDERICK: That's correct.

MEMBER CORRADINI: Thank you.

MR. FREDERICK: Roughly, the dose results are proportional to the integrated leak rate over 30 days. And if you look at what the integrated value is for this leakage over that time period, it's about a factor of eight different, so even if there is some variability, or uncertainty in the application of this test data, there is a lot of margin between what we would actually expect, and what the dose analysis -

MEMBER BANERJEE: Just going back to Mike's question. Is most of this resistance coming from the concrete, or is it just close to the hole?

MR. FREDERICK: Most of the resistance is coming from the concrete.

MEMBER BANERJEE: So, if the concrete, for whatever reason, actually by this resistance, what would the flow rate be?

MR. FREDERICK: We did a calculation, just what that flow area would provide at the peak accident pressure, and the difference is about a factor of 100, so it's pretty substantial.

MEMBER BANERJEE: That hole would allow large flow to go through. Concrete is -

MR. FREDERICK: Right. If there's no concrete, you would get a much higher flow rate.

VICE CHAIRMAN ABDEL-KHALIK: Well, let me go back to the question I raised earlier. This is a sub-atmospheric container, at least initially it operated at sub-atmospheric conditions. During that period, some buckling of the liner occurred, and, therefore, a gap was created between the liner and the concrete. Is that correct?

MR. MANOLERAS: What we'll do is, we'll have Tom Westbrook come up and talk -

VICE CHAIRMAN ABDEL-KHALIK: Let me just follow the logic. Okay?

MR. MANOLERAS: Okay. I'm sorry.

VICE CHAIRMAN ABDEL-KHALIK: So, is that correct?

MR. MANOLERAS: Our liner is attached to the concrete with Nelson studs.

VICE CHAIRMAN ABDEL-KHALIK: Yes, I understand. Nevertheless, the liner buckled in during that period. And, therefore, one would assume that there was a gap between the two somewhere.

MR. MANOLERAS: Yes. I'll invite Tom Westbrook to come up and speak to the design of the containment liner.

MR. WESTBROOK: This is Tom Westbrook. I'm the Lead Civil Structural Engineer in Beaver Valley. Your description is not accurate. The liner is designed with Nelson studs on the back, which attach it to the concrete structure. Part of the design criteria was to make sure that that liner is anchored to the concrete structure during sub-atmospheric operation. So, no, there was no separation or gap created between the liner and the concrete.

VICE CHAIRMAN ABDEL-KHALIK: Okay. Let me -- it's anchored at discrete points corresponding to the studs. Is that correct?

MR. WESTBROOK: That is correct.

VICE CHAIRMAN ABDEL-KHALIK: Okay.

MR. WESTBROOK: The design is such that -- the spacing of the studs were such that the strength of the liner was such that it would not pull away during sub-atmospheric operation.

VICE CHAIRMAN ABDEL-KHALIK: So, it didn't deform at all, if I have the studs on some kind of square lattice. It didn't deform at all between four neighboring studs. Is that what you're telling me?

MR. WESTBROOK: That's correct. Yes.

MR. SENA: And, again, for clarity, the spacing of the Nelson studs, it's one foot center.

Correct, Tom?

MR. WESTBROOK: They are one foot on center diamond pattern.

VICE CHAIRMAN ABDEL-KHALIK: Okay. All right. Thank you.

MEMBER ARMIJO: I'm sorry. I misunderstood you. What's the spacing now?

MR. WESTBROOK: One foot.

MEMBER ARMIJO: One foot. Thank you.

MEMBER MAYNARD: I'd like to suggest we get into what are the actions can we take. I think we could debate all day long the safety significance and go over a lot of this stuff. I'm not sure -- to me, what seems to be more important is, is what inspections, what's going to be done to insure that the integrity of the liner going into the period of extended operation, and we haven't really got into the monitoring program yet. To me, that seems to be more important for what we're here today to discuss.

VICE CHAIRMAN ABDEL-KHALIK: But, nevertheless, the case is being made based on this estimated leakage rate, and the question is, are there other conditions that exist that would cause this to be under-estimated? And that's what we're trying to find out.

MEMBER BANERJEE: I guess there are two questions. One is that -- the second is, is this actually progressing, or is it simply something that has happened, and has become sort of idealized? So, if it's an aging-related issue, where these corrosions that you are seeing can be getting worse, then I think we need to address that issue. I'm not assured that we have found that this is not, in some way, aging-related.

CHAIRMAN BONACA: Well, I think that Otto's point is well taken, let's hear from them what they have done differently from what they presented to us before, and that may raise questions that you're suggesting here. I think that will be fair, but for the benefit of time, let's move on to -

MR. CUSTER: Okay, if we can continue, then. Details of the examination plan are as follows. IWE visual examinations. You'll see that we'll be doing additional IWE visual exams. Non-random examinations, looking at those areas that we think are possibly susceptible. Random sample examinations using statistical random sampling to determine additional details, and give us some idea of the remaining condition, this type of condition within the liner.

Our IWE visual inspections are performed in addition to the Code requirements, so we're looking to establish the condition of the interior liner surface at the time of the inspection. And that will tell us right then and there where we are with things. Additional IWE visual inspections will be performed at both Unit 1 and Unit 2, as defined by the ASME Code. And I'll provide an overall schedule for each unit, as we go through this.

Non-random examinations. Those are volumetric examinations using ultrasonic testing to the liner. We'll be looking at a minimum of eight locations at each unit. We'll be using site-specific and industry operating experience to identify these areas with potential characteristics for this type of corrosion to exist.

Unit 1 we will commence -

MEMBER SHACK: What kind of corrosion are you intending to detect by this examination?

MR. CUSTER: We are specifically looking for the type of corrosion that would be affiliated with foreign material, that would be a pitting-type of corrosion, pitting that has some defined shape with it, and a breadth of pits.

MEMBER ARMIJO: Do you have any

information from the period of construction, photographs of how the rebar was positioned, where wood might have been used as spacers? Do you have drawings? Have you interviewed people who actually did that work to help guide this non-random?

MR. CUSTER: We have photographs. Wood was used to offset the non-structural rebar from which the structural rebar was provided. There was a quality assurance procedure to provide general inspection to insure that the wood was removed. However, our review of the details of that procedure did not specifically -- we did not specifically find sign-offs from an inspector for each area of wood.

MEMBER ARMIJO: And, obviously, one wasn't removed, a six inch piece was left there. So, you would know roughly about what the spacing would be, and what elevations these wood blocks would be, and that will help guide your non-random. Is that your thought?

MR. CUSTER: That is correct. You will see in the following slide, I'll talk about some of the areas that we've chosen. Right? But we would look -- specifically, we're going to look where the 2009 event was.

Now, keep in mind, we feel as though this was, essentially, limited non-compliance to a general procedure. We don't think the procedure overall failed. We think this is a limited case.

MEMBER SHACK: And how large are these areas?

MR. CUSTER: The spacing typical wood looks like it would be a two by four roughly six inches or one foot long, roughly.

MR. SENA: The area of inspection.

MEMBER SHACK: Area of inspection.

MR. SENA: One foot.

MEMBER SHACK: Okay. So, we're talking about five extra patches of one foot by one foot, and three extra patches.

MR. CUSTER: Eight at each unit.

MEMBER SHACK: Eight.

MR. CUSTER: And I'll qualify that in the next slide.

MEMBER ARMIJO: But you know the spacing between these wood blocks according to your drawings or pictures, so at least you have a pretty good chance of finding it, if it was there.

MEMBER SHACK: Well, I think if you look at their next slide, they give their criteria on how they choose these locations. Is that correct?

MR. CUSTER: That's correct. I'll talk to that here just in a second. Let me clarify the final bullet, that Unit 1 will commence while we're on line. These inspections within the current fuel cycle for non-random and complete them by December 31st, 2010, the end of our next outage at Unit 1. Okay?

So, based on the OE, and review of our containment design at Unit 1, we're going to look at these typical areas. Now, as I said, we'll do a minimum of eight at each area. Right?

MEMBER BLEY: How did you come up with eight? Why eight? Is there a basis for that? Do you think it covers things?

MR. CUSTER: We think that eight is representative of the type of irregularities that we would see, and it's representative of areas that, maybe, potentially, have this condition.

MEMBER BLEY: So, from each of these eight things on this slide, you took one location.

MR. CUSTER: I'm sorry. Can you say that again?

MEMBER BLEY: No, never mind. I'm just -

MR. CUSTER: Okay. We're looking at eight for each unit. In other words, although we've picked five areas, we'll look at a minimum of eight. This is basically an extension of the cause. Right? And if we find something from that, then we'll consider what we need to do from there. So, we're going to interrogate the areas that were painted more than once. We've had a couple of cases where the top coat at Unit 1 has come off. The primer coat was tight, but we're going to take a look. We never UTed behind those.

VICE CHAIRMAN ABDEL-KHALIK: Now, what do you mean by "irregular contour"?

MR. CUSTER: Irregular contour, and I think that in earlier discussion, possibly we had some beginning of that. Irregular contour is an area where the surface did not stay with the same radius, where there is some degree of bowing. We believe that that had occurred during original construction. We've monitored these areas at Unit 1 since 1980. They have not changed.

VICE CHAIRMAN ABDEL-KHALIK: So, again, back to the question. This irregular contour you think happened during the concrete pour?

MR. CUSTER: Yes.

VICE CHAIRMAN ABDEL-KHALIK: Or after the concrete pour?

MR. CUSTER: During the concrete pour,

even possibly before.

VICE CHAIRMAN ABDEL-KHALIK: So, how would it have happened before?

MR. CUSTER: Potentially bowing, as you build the tank. There was a specification for a general radius. There was a specification to allow some irregularity.

VICE CHAIRMAN ABDEL-KHALIK: Okay. So, again, you would -- the hypothesis is that most of this happened during the concrete pour, so the liner and the concrete remained in intimate contact.

MR. CUSTER: We believe them to be in intimate contact. That's correct.

VICE CHAIRMAN ABDEL-KHALIK: There is no annular -- there's no gap anywhere where gas can actually be present.

MR. CUSTER: That's what we believe to be the case.

MEMBER ARMIJO: Gas will always be present in that interface. There's no way that those things could be leak tight. Water may be a different case, but gas is going to be there.

MEMBER SHACK: But he's talking about a macroscopic gap.

MEMBER ARMIJO: Right. Yes.

VICE CHAIRMAN ABDEL-KHALIK: I'm trying to find out what the velocity through that hole will be during hypothetical accident, where the pressure in the containment may be greater than twice the pressure in whatever gas gap may be present. And if it is in the velocity through that hole will be equal to the speed of sound, and then if you have gas going at the speed of sound through a hole, how does that affect the containment? That's the line of questioning that I'm trying to get to.

MR. CUSTER: Give us a moment. Ken Frederick, our Senior Design Analyst, will talk to that.

MR. FREDERICK: Just to clarify your question. This is Ken Frederick. You question is, what effect would gas flowing through the gap between the liner and the concrete, would that have on the concrete, or the liner?

VICE CHAIRMAN ABDEL-KHALIK: Well, if I have a gap in-between, imagine, if you will, and if the pressure in that gap doesn't keep up with the rapid rise in pressure inside the containment, so that you have roughly a factor of two of pressure difference between inside the containment, and in that gap, the velocity of the gas going out through that hole will be equal to the speed of sound. So, it is important that you convince me, at least, that there is no gas gap in-between.

MEMBER BANERJEE: Is your concern, Said, that the flow in this gas gap, which has an extremely large area, will find some part of the concrete?

VICE CHAIRMAN ABDEL-KHALIK: No, I'm just now -- would be -- if that scenario is true, then I would be concerned about a gas jet moving at the speed of sound that directly impacts the concrete.

MR. CUSTER: This would not -- this is Cliff Custer. We're not talking about an infinitely large area here, where the -

VICE CHAIRMAN ABDEL-KHALIK: That's why we're asking.

MR. CUSTER: We're really not talking about an infinitely large area. I would ask maybe Jack Paterson to come and qualify the size of these areas. Jack is the Containment System Engineer. He can probably help us out with that.

MR. PATERSON: Good morning. I'm Jack Paterson. I'm the Containment System Engineer. These irregularities, there were a number at Unit 1. And, as Cliff stated, we did monitor those for a number of years to see if they were growing. They did not grow.

We felt that they could have been growing because we were sub-atmospheric. There was a concern about that. They did not grow. We didn't see them change in any way, so we do feel that they are in tact with the concrete.

We also did the inspections at Unit 2 prior to -- during construction, prior to pulling vacuum on the containment. Those irregularities were there prior to pulling vacuum, so that they weren't caused from the vacuum. Again, we also feel that they are in tact with the concrete.

I agree that there is probably a small gap between that concrete and the containment liner. I would think that the pressure test, though, would tend to push the liner, because it has no structural strength, to the concrete and close that gap up during a design-basis accident.

VICE CHAIRMAN ABDEL-KHALIK: Thank you.

MR. WESTBROOK: This is Tom Westbrook, again. I was present when we removed the section of the liner that was corroded this year, and discovered the wood behind it. The concrete was in direct contact with the liner, and on the edges of the cuts you could not slide a piece of paper against it. And, as Jack stated, under design pressure, the pressure is outward, so if there was a very, very small gap there, it would tend to close off.

VICE CHAIRMAN ABDEL-KHALIK: Thank you.

MEMBER ARMIJO: Well, don't forget about thermal expansion. Steel will expand more when it's hot than the concrete, so there's going to be some gap, but it's not going to be a big gap.

CHAIRMAN BONACA: Okay. Let's move on to-

MEMBER SIEBER: Well, the calculation on supersonic flow is an easy one to make, a theoretical standpoint. It's just an orifice flow. I don't see any volunteers here ready to sit down and do it, but that's something that probably most of us could produce.

MEMBER MAYNARD: Well, if there is a gap, the pressure is going to either equalize quickly, or else, if it continues, it means you've already got a breach in the containment anyway, the concrete.

MR. CUSTER: Okay. If we can move on now. The random sample examinations now. The random samples, we're talking about a minimum of 75 sample locations selected to conform with statistical guidance traditionally from an EPRI document, and NUREG 1475.

For that sample, we're looking at a one

foot by one foot random sample location chosen randomly to do ultrasonic testing on those portions of the accessible liner surface. That's similar size to what industry OE tells us. If you look at one by one foot area, you should find it.

Now, what I'd like to say is that the final bullet here, and then we'll go back to the bullet on failure, that the sample plan is designed to provide 95 percent confidence, that 95 percent of the accessible unexamined areas are similar to the data obtained through random sampling.

We would define a statistical sample failure, one that would cause us to re-look at our sample plan, and determine what to do statistically, is an area following engineering evaluation that was greater than 10 percent material loss due to active pitting corrosion, not attributed to fabrication or erection practices. That's what we would consider a statistical failure, and that would affect -- encourage us to take a look at another lot or so.

MEMBER BLEY: Let me ask you -

MEMBER SHACK: Now, if you find a pit that's 20 percent deep, how are you going to determine whether that's an active process or not?

MR. CUSTER: If it's 20 percent deep, we

would say it's active.

MEMBER SHACK: Okay. So, what you really mean is if you're going to find things greater than 10 percent, that's a failure.

MR. CUSTER: That's correct.

MEMBER SHACK: Okay.

MR. CUSTER: That's correct. Anything greater than 10 percent that has localized pitting and looks like this condition, we would consider a statistical failure.

MEMBER BLEY: Now, let me sneak this one in. As I understand the way you're going to test, you're doing 100 percent visual before you do the UTs. Right?

MR. CUSTER: We're going to do an additional IWE visual before we do the UTs. That's correct.

MEMBER BLEY: The one you found, you found through a visual.

MR. CUSTER: That's correct.

MEMBER BLEY: And since that's repaired, you're not counting that as a failure. If you find more through the visual, what this sample plan is going to do is see if the UT finds something visual doesn't find, and evaluate whether your sampling has -

- whether you find anything that way that you didn't find visually, so it's after the visual is all done.

MR. CUSTER: That's correct. And it complements, if you will, it complements the visual inspection.

MEMBER BLEY: Thanks. Said.

VICE CHAIRMAN ABDEL-KHALIK: How do you sort of confirm the second clause in the third bullet of Slide 12?

MR. CUSTER: Yes.

VICE CHAIRMAN ABDEL-KHALIK: That it is not attributed to fabrication/erection practices?

MR. CUSTER: Yes. During fabrication, keep in mind this was a large tank outside that took a couple of years to build. Right? There were wind braces that were placed on and then ground off. Right? So -

VICE CHAIRMAN ABDEL-KHALIK: I don't think you understand my question.

MR. CUSTER: Okay. Could you restate it, please?

VICE CHAIRMAN ABDEL-KHALIK: Okay. One of those random samples will show greater than 10 percent material loss. How would you say that that is not attributed to fabrication/erection practices?

MR. CUSTER: Number one, if we determine that it was not a pitting attack similar that would have shape like our FME has shown, that we may have something else going on. We would have to consider what we would do about that. Right?

The first thing we would do, if it was not traditional, if it did not indicate like traditional foreign material corrosion would, which is a localized area of corrosion with some pitting attack that had a shape to it, we would have to take a look at it. We'd have to characterize that flaw, evaluate and consider what we'd do. It may be something new that we'd have to look at. Keep in mind, the general liner surface has never been exposed to overall ultrasonic testing.

MEMBER ARMIJO: I'm really confused. In the 2006 examination, you found pits far greater than 10 percent deep. And somewhere in the SER, or in your submittals, you attributed that to corrosion that probably occurred during construction. You couldn't say for sure, but you did. That's what I remember reading.

So, now if you find with this new exam, if you find pits greater than 10 percent of the wall, you're going to say that's due to current or active corrosion? I don't understand.

MR. CUSTER: Keep in mind, the foreign material would have introduced itself during construction. Right? So, if we find pitting attack, we would recognize that as foreign material that was left behind from construction. We would consider it random failure.

The two areas that we identified, if they were a random sample plan, the two areas that were replaced in 2006 would be considered a random sample failure, if we were under the same sample plan.

MEMBER ARMIJO: See, that's what I was -- I thought that's what you were doing, that the random sampling was to address pitting, not related to foreign material, just pitting. And that you're guided or non-random was to look for these locations where these wood blocks might have been left behind after construction. And I can understand your logic that way, but 10 percent of the wall is a pretty small number, and your conclusion will be that it's not due to construction corrosion, but it's due to active corrosion going on right now.

MR. MANOLERAS: Yes, we did pick a very conservative number for potential statistical failure criteria. That 10 percent loss of material we would consider to be a statistical failure, unless there was a way that we could determine it from the fabrication or erection process, that it was, as Cliff mentioned, grinding off one of these wind braces.

MEMBER ARMIJO: Okay. I understand.

MR. MANOLERAS: Or taking one of these Nelson studs and having to re-weld that, or rework that. If we can't determine it to be that, we would consider it to be a statistical failure -

MEMBER ARMIJO: Okay. I understand what you're doing.

MEMBER BLEY: I'm still not completely clear. Is this, I'll call it an exclusion of things attributed to fabrication/erection practices. Are the things you're excluding there, the things where you think whatever you find occurred at that time of construction, and nothing has happened since then?

MR. CUSTER: Let me offer, for instance, during fabrication or erection, if an arc strike were to have occurred on the wall, as we all know, those get blended. There would be some pattern to it. We would need to assess whether we thought that was an arc strike, or if it was localized pitting attack, rather than just a general surface. If we could discriminate that, we would determine it to be just that, an erection-type practice.

MEMBER BLEY: Okay. So, it's not a -- it's something that wouldn't have been a corrosion -

MR. CUSTER: Something not attributed to corrosion.

MEMBER BLEY: Okay. Thank you.

MEMBER CORRADINI: So, just to be clear, we've been gabbing privately. So, everything that's greater than 10 percent is in until you determine, based on some thinking process, that it now falls back out.

MR. CUSTER: That is correct.

MEMBER CORRADINI: Got it. Thank you.

MEMBER BROWN: Can I ask a question, please? The unexamined area that you talked about, 95 percent confidence at 95 percent of the unexamined area, does the unexamined area include the inaccessible part of the liner, or just the accessible part of the liner?

MR. CUSTER: The area for UT would be the UT accessible area. Keep in mind -

MEMBER BROWN: I understand that part, but you're doing your statistics based on the unexamined areas. Is that -

MR. CUSTER: It would be based on the accessible section of the liner.

MEMBER BROWN: So, all of the unaccessible is not included in the statistical evaluation.

MR. CUSTER: That is correct. What we would use is, we would use the information, the data that we got from the random sample plan to gain the insight. We would then need to apply some statistical analysis to that to determine what we would think about the inaccessible portion.

MEMBER BROWN: How much of the total containment liner, percentage-wise, is inaccessible?

MR. CUSTER: Dave, do you want to talk to that?

MR. GRABSKI: Yes, Dave Grabski.

MEMBER BROWN: It probably would just be a number.

MR. GRABSKI: Yes, it's actually less than 6 percent of that part of the portion of the containment liner that is susceptible to this -

MEMBER BROWN: I'm talking about the whole liner, the whole liner.

MR. GRABSKI: Yes, the wall and the dome.

MEMBER BROWN: Yes. And you say only 6 percent is inaccessible.

MR. GRABSKI: Right. Things like the elevator shaft, and also the floor. There's two foot of floor that covers -

MEMBER BROWN: The lower portion.

MR. GRABSKI: Right. We have, also, we have overlay.

MEMBER BROWN: So, that's the 6 percent that you're talking about. That's all part of the 6 percent?

MR. GRABSKI: That is correct.

MEMBER BROWN: Thank you.

MR. CUSTER: Okay. Continuing on, let's take a look at the examination plan summary then. That would be Slide 13, for Unit 1.

For Unit 1, we'll be doing additional visual inspection in the year 2010. That's 100 percent IWE visual inspection. In 2012, that's our normal scheduled IWE visual inspection that will be done, as well. Non-random examination schedule, we'll begin the non-random examination schedule in this current fuel cycle. All eight of the non-random exams will be completed by December 31st, 2010. With respect to the random examination schedule, the initial sample consisting of a minimum of 75 will be complete by the end of the next three refueling outages.

After we gather the data, we will evaluate if a statistical method to analyze the data, so that we can gain additional insight for the general liner condition can be applied. We will document a summary of the examination plan results, and the entire random sample plan will be completed prior to entering the period of extended operation.

At Unit 2, similar to Unit 1, we will complete an additional IWE visual inspection. A visual inspection will occur in this 2009 outage upcoming for Unit 2, and the normal scheduled IWE examination will be completed in 2011 during that refueling outage. The non-random examination schedule will be completed prior to entering the period of extended operation, and the random sample examination schedule will consist of a minimum of 75 random samples.

We will commence that random sampling by the end of the refueling outage in 2011. As we gain data, we will evaluate if a statistical method to analyze the data and gain additional insight for the general liner condition can be used. We'll document a summary of the inspection plan results, and the entire random sample plan will complete prior to entering the period of extended operation.

What that, I'd like Mark Manoleras to -

MEMBER STETKAR: Can I ask you a question?

MR. CUSTER: Yes.

MEMBER STETKAR: If your non-random examination process is what I'd call kind of an informed sampling process, where you're checking in areas where you have somewhat suspicion that there might be a problem, why are you deferring that non-random examination on Unit 2 until sometime before 2027, rather than doing that now?

MR. CUSTER: We simply haven't seen the problem at Unit 2. We've done some additional look at the construction practices used at Unit 2. We believe the use of wood was very limited at Unit 2. Instead of the, for instance, and this is recent discovery, it looks as though the liner rather than use wood spacers, actually used welded angle wire as a standoff. So, that's one of the reasons why -

MEMBER STETKAR: Well, that might be different criteria for selecting locations that you check on Unit 2, but I guess I still don't quite understand the rationale of why not check those perhaps different locations sooner than later?

CHAIRMAN BONACA: Let me ask you maybe in a different way. You have three outages in which you would perform 75 UTs. What happens if in the first batch of 25, you have findings, are you going to accelerate the number of UTs? I mean, are you going to change these groups of 25?

MR. CUSTER: What we would have to do is, we would have to address them in statistical fashion so that we maintain that confidence level, yes. We would have to take a look and see, based on the information that we gain, would there be further insight? How do we adjust the plan? We would have to adjust the plan to maintain a statistical 95-95 confidence level, yes.

CHAIRMAN BONACA: You will adjust the plan both in terms of how many are going to inspect, as well as the timing?

MR. CUSTER: We would have to look at it to extend the cause, number one. If we gain more information, look at locations that would be similar, for instance. And we would have to adjust the sample plan. That's correct.

MR. SENA: Again, if I can clarify, if through the non-random inspections we find an item that would exceed the statistical failure criteria resulting in an increased population, we did commit that that entire random sample plan, even if we have to increase the population, would be complete before the period of extended operation.

Now, one of the things that we believe is very important is that that initial 75 -- minimum 75 samples be complete within the next three outages. What that then affords is the staff to come in during their 71003 inspection, and assess those results, opportunity to inspect, assess, evaluate what we've done in our corrective action program before the period of extended operation.

MEMBER RYAN: You know, I'm a little confused. You're talking about random sampling and biased sampling all in the same sentence, and the statistical criteria that you quote. It's a little confusing the way you're talking about it. You've got 75 random samples -

MR. SENA: Correct.

MEMBER RYAN: -- from which you can get a percentage of positives versus negatives, and do the usual statistics. How do you deal with that random program separate from, let me call it a biased sampling program, where you're going where you think you're really going to find something, and it's not a random selected location?

The reason I'm asking this is, it's very important to sort out what your rates of positives are, that is, finding the corrosion on a random basis versus fixing the things you know that are already present, and I would call a biased location where you're more likely to expect that. So, all of that has to be kind of carefully laid out, so that you can interpret rates of potential failure in other locations in the future, both in time, and in location. So, help me out.

MR. MANOLERAS: Yes. This is Mark Manoleras, again. You bring up a good point. And there are many questions, and many combinations of failures, so let me try to provide some clarity. Our random sample plan will be taking a look at the liner to insure that we have a 95 percent probability, 95 percent confidence level that the accessible portions of the liner don't have signs of degradation beyond the liner that we talked about, so that's extremely important. So, our sample plan would be adjusted -

MEMBER RYAN: What's the assumption behind that result? I mean, because the distribution of the pitting locations allows you to determine that. I still don't know the basis for your test criteria.

MR. MANOLERAS: Okay, yes. This is one portion of the test that we're talking about here. We're talking about the random portion of that. We also then have the non-random portion, where we're basically taking a look at areas for cause, where we're going out and we're saying hey, there's a very good opportunity that similar conditions may exist. So, we're taking a look at this from a non-random perspective, and we're not -- we do not take a non-random failure into the 95-95 percent random equation.

MEMBER RYAN: I want to go back to the random. I understand the biased. It's at the interface. It's where something happened before. It's at a bolt, whatever it is. That's fine. I appreciate that. But I don't understand how you can say 95 percent confidence interval. What's the basis for the number of samples being 75? How did you get to that 75 is the right number to meet that criteria?

MR. SENA: We understand.

MR. CUSTER: Yes. Let me just quickly describe 75. If we need to talk further details, I'll ask Dr. Harlow to speak to it.

MEMBER RYAN: If you have a statistical sampling plan in which this is laid out, that would be just fine. I'd like to see that.

MR. CUSTER: That's basically where we are. We chose the number 75, we felt as though it's actually bounded by NUREG 1475, so we chose that as -- a minimum of 75 as an area to start.

MEMBER RYAN: That's different. Then that's based on a statistical test criteria. So, I'm just trying to understand, if you're starting with 75, because that seems like a good place to start, okay. But it doesn't tell you what your ultimate statistical results -

MEMBER STETKAR: No, that's how you get to the 75, is from the 95-95.

MEMBER RYAN: But I haven't seen how you get there yet.

MEMBER POWERS: Yes. It's just an independent, identically distributed occurrences of corrosion. Seventy-five is pretty close to a 95-95 -- I mean, plus or minus one.

MR. MANOLERAS: It would be supported by analyses; the number 75 is supported by analyses.

MEMBER RYAN: Again, if you have a written plan, it would be helpful to read it.

MEMBER POWERS: And this is a fairly unusual sampling. It's not like a production process. One failure causes massive rethinking of this whole thing.

MEMBER RYAN: Bingo.

MEMBER POWERS: They've got to come up with zero indications, or -

MR. MANOLERAS: Our sampling plan -

MEMBER POWERS: -- zero unexplainable indications. And then you walk away.

MEMBER BLEY: And from -- they pointed us to a methodology document last time around. Now, let me just ask a judgment question -

MEMBER RYAN: The methodology document is different -

MEMBER BLEY: -- that follows up on what Dana said.

MEMBER RYAN: Dr. Bley, a methodology document isn't necessarily the same as -

MEMBER SHACK: This is a truly simple-minded argument. This is simply a binomial sampling: red balls, white balls, 95-95, you come up with the number.

CHAIRMAN BONACA: Let just say -- I would like to say one thing following my line of thinking before. You're tying together the three inspections to license renewal, because you're saying that they are going to complete it during this before the period of extended operation.

MR. CUSTER: That is correct.

CHAIRMAN BONACA: So that seems to justify a pace that is pretty slow, in so far as the way you do the inspection, which presumes that you're not going to have many problems there. Assume that you have the first set of 25, and you find some problems, I would view that it would be important not any more to key your objection on the license renewal. It seems to me that they would become more and more of a current license period problem. Would you -- I'm trying to understand how aggressively you would change your inspections to reflect that kind of conditions.

MR. SENA: Again, this is Pete Sena. So, the plan currently, the minimum of 75 to do within the next three outages at Unit 1, that was picked specifically, such that it was done before the NRC's 71003 inspection.

If we find a problem, let's say at the next outage, we do our first sampling of 25, we find a problem, it has to be entered into our corrective action process. We have to evaluate that, expand its scope, and go through a timeliness evaluation to pull up and do an accelerated schedule. All right?

So, again, I can go under hypothetical scenarios, but the bottom line is, what we find, we have to evaluate, characterize, put into corrective action, assess and correct in a timely manner. If that would then entail accelerating it, that may just be the case.

CHAIRMAN BONACA: Let me ask you one last question. Your judgment, I mean, you live there, you have inspected there, you have looked, is your expectation that you'll find defects or not?

MR. SENA: No.

MR. CUSTER: Our expectation is we would find no defects.

CHAIRMAN BONACA: No defects.

MR. CUSTER: That's our expectation going in.

MEMBER SHACK: That's his statistical hypothesis.

CHAIRMAN BONACA: But I wanted to hear that, because, again, I mean, there is -

MEMBER SHACK: You can have some side bets.

MEMBER BLEY: It also follows their 100 percent visual inspection. I don't know if that answers the same way, if you ask him that question.

VICE CHAIRMAN ABDEL-KHALIK: I still haven't heard the answer to Mr. Stetkar's question, as to the logic for delaying the non-random examination for Unit 2, if it is expected to inform the random examinations for Unit 1. The non-random examinations for Unit 1 are expected to inform the random examinations for that unit. And the question is, if that is the case, why are you delaying the non-random examinations for Unit 2?

MR. SENA: So, on Unit 2, we have not identified any corrosion of concern. We have continued to perform our visual inspections, Type A inspections. However, but, we do need to do UT exams. We agree with you. Now, timeliness of those UT exams, all we are saying here is that they will be completed prior to the period of extended operation. And we have not yet laid out the time line for the Unit 2 examinations. No known issues, but our first course of action, the priority is Unit 1 on the non-randoms. We do the non-randoms on Unit 1 by 2010, essentially within the next 13-14 months. If we find issues on these non-random inspections, extended condition would then dictate an increased time line on Unit 2, as well.

VICE CHAIRMAN ABDEL-KHALIK: Right.

MR. SENA: A narrower time line, a quicker time line. So, again, our inspections are OE-based. What else do we find? We do not expect to find anything, have not found anything. Construction practices were different at Unit 2, so if there is a need to, we certainly would. Right now, the only formal docketed commitment is that we would do it before the period of extended operation.

MEMBER STETKAR: I guess I still don't understand the rationale for Unit 2. You're saying that because you have not had any problems with Unit 2, you don't expect to have any problems with Unit 2. Therefore, you don't need to go look for any problems with Unit 2. Wouldn't -- let me turn it around and say, as a confidence builder, wouldn't it be good to go look at the areas of Unit 2 early, to further reinforce your confidence that, indeed, you don't have any problems with Unit 2, and, indeed, the two units are very different, for whatever reason.

MR. SENA: All right. So, again, yes, we have not found anything. Do I expect to find something? No, I don't, but we are going to go do non-random samples. Now -

MEMBER STETKAR: But if I don't do those until 2027 -

MR. SENA: That's not what we're saying. We are not saying we're going to delay it until 2027. All right?

MEMBER STETKAR: Well, you're not saying you're going to do it in 2012, either.

MR. SENA: And that's what we're looking at from our timeliness aspect.

MEMBER STETKAR: Okay.

MR. SENA: Will it be done before the period of extended operation? Absolutely. Could it be done by 2015? Certainly. Could it be done by 2014? Certainly. We have not laid out that time line, as of yet.

MEMBER ARMIJO: What's your -- you may not have a detailed time line, but what is your intention? Do you want to get this thing out of the way, and out of your hair quick, or do you want to just let it go until it's convenient?

MR. SENA: So, again, so we go back to my discussion about the INPO principles. All right. We certainly want to get this out of the way and done. All right? We need to look at our outage scope, our outage inspection plans.

MEMBER ARMIJO: Okay.

MR. SENA: Non-destructive examination resources, other activities within scope, and simply get this done, and get it behind us. What would be most beneficial to us, all right, again, at Beaver Valley, is to complete the non-random in addition to the completion of Unit 1 before the 71003 inspection.

Our goal, our ultimate goal is to have all the information available to the NRC before the 71003 inspection. That, to us, is our critical juncture.

MEMBER ARMIJO: Okay.

MEMBER BLEY: Have you finished with your presentation?

MR. CUSTER: Yes.

MEMBER BLEY: Thank you very much, and I would like -

MEMBER POWERS: Dennis, I would like to -

MEMBER BLEY: Yes, Dennis.

MEMBER POWERS: I would like to come to your last slide. I don't think he had a chance, actually, to walk through it.

MR. MANOLERAS: Okay, yes. Pete's already talked a little bit about the first bullet, but let me follow-through there. Again, this is Mark Manoleras. The liner through-wall defect is consistent, we believe, with other industry limited OE on the subject. We believe our examination plan will incorporate that recent OE, and also provides reasonable assurance of the liner condition prior to the period of extended operation.

The important thing is, also, the results of the examination plan will be shared with the industry, and the results of the inspections, or the examinations, will be docketed following their completion.

MEMBER POWERS: What I would like to explore just a little bit with you is, we're asked to reach a conclusion of reasonable assurance at this particular structure, which is an important element of defense-in-depth can be managed, with reasonable assurance it can be managed in the period of extended operation. And, unfortunately, we're being asked to come to that conclusion today, and not at the end of your inspection. And I wondered how you thought we would come to that conclusion? How do I reach this conclusion of reasonable assurance today?

MR. CUSTER: Let me respond to that. We've laid out an examination plan, we've laid out the process by which we will further identify, either verify, or determine if it does not exist in our containment liner. We've described to you what our actions would be. We've described to you what our timeliness would be. As we said, as we find things, we will characterize what we find, we'll evaluate them, and readjust our plan to provide the confidence level that this condition does not exist in our liner.

MEMBER POWERS: But we should focus in our deliberations on whether we have reasonable assurance or not on, first, the quality of your plan, and the criterion by which you declare defect. Now, what constitutes a defect? You've taken a reasonably conservative, 10 percent pitting that you can't otherwise explain is considered a defect. And it's on that basis that you think, plus all the other stuff which you've submitted, and you've submitted quite a lot of stuff, but that's the key thing that we should focus on in arriving at a conclusion of reasonable assurance. That's your position, or your recommendation to us.

MR. SENA: Well, again, in addition with what we've done to-date. So, it's the Type A test, recognize that we did on Unit 1 complete the visual exam of 100 percent of the accessible liner, found no other issues with the rest of the liner. Our next outage, we will do another 100 percent visual inspection of the liner.

MEMBER POWERS: When is your next integrated leak rate test scheduled for?

MR. CUSTER: I'd ask Jack Paterson, our system engineer, looking that up right now.

MEMBER POWERS: Jack, you can give me a round number. I don't need a specific date.

MEMBER SIEBER: Time and date.

MR. PATERSON: We completed our last Type A leak test 2006, spring 2006. It will be 10 years from that, roughly 2016.

MR. SENA: And, if I can, Jack is the engineer who identified this paint blister. Jack is the engineer that's done this year in/year out, and has done the 100 percent visual inspections. Jack, do you want to maybe comment on the health of the liner, what you've seen?

MR. PATERSON: I take pride in the liner, and the containment buildings, both units. I think they're in excellent condition, both units. We maintain our liners. With the new containment sump issues that have -- in the industry, we've really gone over our liners, particularly looking for any paint defects, and repairing them. I feel very confident with both our liners.

MEMBER ARMIJO: Thank you.

MEMBER POWERS: That is helpful, by the way. I mean, you understand what our problem is. We don't have the benefit of waiting for your sampling results. We have to arrive at a conclusion now, and I'm struggling a little bit with the -- what I hang my hat on to arrive at that. And what you've said is very helpful.

MEMBER BANERJEE: I think it would be helpful for me -

MEMBER POWERS: And Mr. -- your liner engineer is -

MR. SENA: Mr. Paterson.

MEMBER POWERS: Mr. Paterson is confidence-inspiring.

MEMBER BANERJEE: It would be helpful for me if you would, perhaps you've said it already, explain how assured that these things are not progressive. In other words, will there be sort of a repeat check to see that, indeed, whatever you find happened earlier, and nothing is going on now, which continue to sort of age and diverse during this period of extended operation? Just make it sort of a summary statement as to how you give us that assurance.

MR. CUSTER: We don't believe we have an issue that we're going to find. However, if we find an issue, we're going to look at it. We're going to characterize it, evaluate it. We'll consider what we need to do in our sample plan to look further. We'll put it in our corrective action plan. Pete has addressed how we would look at the timeliness issue. That's how we would handle it, as we go forward.

MEMBER BANERJEE: But how will you identify that issue?

MR. SENA: So, we go through the UT inspections, speculate we find an area of concern. We can speculate and say it's 8 percent degradation. Eight percent, we evaluate, we characterize, we do not walk away. We have to make then a decision, we would then continue to monitor that exact same location to identify if the corrosion mechanism is still occurring, and still active, or do we evaluate and say at 8 percent, that's unacceptable. Let's cut it out, remove it, and do an analysis of that plate that we removed, and identify what's behind it.

MEMBER ARMIJO: Well, that's what you're doing with the defect you found in 2006. You're continuing to monitor to see if it's an active corrosion, rather than just patching it, and forgetting about it.

MR. SENA: That is correct.

MEMBER BANERJEE: Okay. So, what you're saying is that if you don't cut it out and fix it, then you will continue to monitor it.

MR. SENA: Absolutely.

MEMBER BANERJEE: And if you then see deterioration, then there is some mechanism operating, which is related to aging, or maybe aging. I don't know. I'm not sort of getting a clear picture of how you will know that there are no progressive aging-related effects. What are you going to do to address that issue? Okay. So, you find something, you cut it out. There's no way to know what's going on. Right?

CHAIRMAN BONACA: No, they will assess where it's coming from. If it is an original defect, if it is, in fact, progressive, and monitor progress in case of doubt there is concern with progress currently.

MEMBER BANERJEE: I agree, but now they remove this piece for this area, they found these things on the liner. At that point, they say they don't know what caused this, whether this is something related to -- and there's no real root cause identified. In fact, if you look at their slides, they leave it open. Right? Wherever this is. They don't know. They say, three areas of corrosion were identified on the liner plate. The lab analysis has not identified the cause for the corrosion. That's the statement. Right?

MR. CUSTER: If I may address that question. In 2006, that evidence was destroyed by hydro demolition. We took the removed areas, did analysis on those removed areas. It was non-conclusive. But as you look at those areas, those areas had roughly a one foot by one foot area. There was something localized going on. There was localized pitting attack. It's true, that a direct cause, the exact material could not be identified and found, but it is quite apparent to me that it was due to foreign material. We found in 2009 that the direct cause of the corrosion was, in fact, foreign material, a piece of wood, a piece of two by four. It had a very low pH, and it had a high moisture content, which accelerated that corrosion rate. And we would perform an analysis of areas removed similar to what we just did in 2009.

MR. SENA: And in all cases going forward, as we've done in the past, if we find an area of concern, an area of degradation, this cannot be a fix and forget. It has to go through, you characterize, you evaluate, and determine the right course of action, dependent upon what we see.

CHAIRMAN BONACA: Okay. We're well beyond schedule. I mean, almost an hour. So, let's move on to the other two presentations.

MEMBER BLEY: Okay. It's time to move to the Staff. And maybe you can address a few of these last questions from the Staff's point of view.

(Off the record comments.)

MR. HOLIAN: Ready to resume?

CHAIRMAN BONACA: Let's resume the presentation.

MR. HOLIAN: Okay. This is Brian Holian, Director of the Division of License Renewal, just resuming with the Staff's presentation. I'll make introductions right now. We will speed up the Staff's presentation, and particularly concentrate on questions on the slides, especially the first four or five slides, or six are somewhat duplicative of what the Licensee has provided. So, we'll quickly step through those, but please pause and ask us any questions on any of that material.

At the middle of the Staff table is Kent Howard. He's Project Manager for Beaver Valley. To his left and right are Hans Ashar and Abdul Sheikh, two Senior Technical Structural Reviewers on the Staff. In the audience are many members that I won't introduce at this time, Dr. Sam Lee, Dr. Raj Auluck. Sam is a Deputy in the Division of License Renewal, Raj Auluck has got the branch involved with structural, and mechanical pieces. We also have two senior-level advisors from NRR Staff, Kamal Manoly, and Allen Hiser, two senior-level, and several branch chief and staff members. This issue does cross both the License Renewal Division, of course, and the Technical Structural Divisions in NRR. And we've worked together on this issue during the license renewal, and in the time period from the last meeting.

With that, I'll it over to Kent.

MR. HOWARD: Good morning. As Brian stated in the introduction, my name is Kent Howard. I am the Project Manager for the Beaver Valley license renewal application.

Since our last meeting on July the 8th, the Staff has been aggressively pursuing a resolution to the containment liner issue. Since that time, we have had a total of eight conference calls. There have been four amendments to the LRA. We're still working on it. As a result, there are revised UT commitments. Also, there have been new commitments added for non-random, submitting the results of the UTs to the Staff, and, also, looking at alternate statistical analysis. The volumetric examination sampling plan, the timing and acceptance criteria, have been clarified, and will be addressed in our presentation. So, we'll get the next slide, go through it a brief time.

This slide highlights some of the information on the Beaver Valley Units 1 and 2 containments, the concrete containments are steel lined reinforced concrete. The concrete shield is 54 inches thick. The liner plate is three-eight inches thick. The containments were originally designed to sub-atmospheric, but were converted to atmospheric containments in 2006. Next slide.

For the remainder of our presentation, I will now turn it over to be Abdul Sheikh.

MR. SHEIKH: So, this slide is just a repetition of whatever the Applicant has presented. The only item of interest is I have put some numbers on the pH value of 3.7, on the piece of wood which was found, and the moisture content of the wood was 13 percent, just to give you an idea.

MEMBER POWERS: Why is the pH so low?

MR. SHEIKH: The wood pH is low, as far as we can figure out, is during the concreting operation the water from the concrete was absorbed by the wood, and it stayed there.

MEMBER POWERS: Water from concrete would ordinarily have a pH of what, 10.8? Why did the wood become acidic?

MR. ASHAR: Normal calcium iron oxide pH

will be 12.5 with concrete, but as the wood pieces, like two by four, they start absorbing more and more of carbon, they being organic in nature, they must be having acidic characteristic to pitting to the -- I'm not a causal engineer. I can't talk more about it, but the pH value that was found by the applicant was 3.5. That is what they told us, 3.7.

MEMBER POWERS: I just wonder why.

MR. ASHAR: Please?

MEMBER POWERS: Why?

MR. ASHAR: Why it happened?

MEMBER POWERS: Why did it become acidic?

MR. DAVIS: Dana, can I answer that? If you have ferrous hydroxide, the pH will be about 1.1, so if you have active corrosion occurring, you would expect a low pH. Jim Davis, from the Staff.

MEMBER POWERS: I guess I didn't understand the answer.

MR. DAVIS: Okay. If you have active corrosion occurring, you're going to produce ferrous hydroxide, which has a pH of about 1.1, so it's in the vicinity of the concrete, so a pH of 3.7 is not unreasonable, if you have active corrosion occurring.

MEMBER POWERS: But this is a chicken and an egg problem here.

(Laughter.)

MR. DAVIS: Not what you asked.

MEMBER SHACK: He's starting with a pH of say 10, and wondering how he's going to get corrosion. Now, if you get corrosion -

MEMBER POWERS: I get a low pH.

MEMBER SHACK: But how do you get the process started with a pH of 10?

(Simultaneous speakers.)

MR. DAVIS: -- with the steel. And once you start getting corrosion, the pH drops very rapidly.

MEMBER POWERS: What you're saying is then, that the corrosion caused the wood to become acidic. The wood didn't become acidic and cause the corrosion.

MR. DAVIS: Say that again.

(Laughter.)

MEMBER RAY: Dana, I think he's saying the wood doesn't protect the steel from corrosion the way the concrete would have done.

MEMBER POWERS: Well, then the question becomes what caused the corrosion?

MR. DAVIS: The wood caused the corrosion.

MEMBER RAY: Well, I guess I thought that if you don't protect the steel, it will corrode in the presence of moisture. And then -

MEMBER POWERS: Any kind of moisture coming in there was going to be roughly equilibrated with the concrete, and it's going to be exceptionally basic. And basic solutions do not attack mild steel.

MEMBER RAY: Okay. But that's the hypothesis.

MEMBER BANERJEE: Need a little CO2.

MEMBER RAY: That's the response, I think.

MEMBER BANERJEE: Typically, in pipelines, if you have water and CO2, you get pitting corrosion.

MEMBER POWERS: Yes. I mean, there you're running a pH of what, 6, something like that?

MEMBER BLEY: And something very local, undoubtedly, gets it started. Huh?

MR. CUSTER: This is Cliff Custer from the utility. I'm the Project Manager. It was customary in the late `60s and early `70s, prior to use of wolmanized wood, to treat two by fours with borated, boric acid, basically, to keep the bugs out.

MEMBER POWERS: Yes. Okay.

MR. CUSTER: And that's where we believe that the pH became -

MEMBER POWERS: That's the answer I

needed.

MR. SHEIKH: Okay. The next slide just, I tabulated the industrial operating experience. And, as you can see, there were three plants, the Brunswick, which is atmospheric containment BWR, and North Anna, which is a PWR sub-atmospheric, and DC Cook, which is a PWR atmospheric containment.

As you can see in all these cases, I have tabulated they were all -- the root cause was identified as a foreign object found behind the liner when the hole was discovered. There was another case in which the pieces of wood were found at the Surrey Unit 2 external surface, but it was not related to through-wall corrosion. The pieces of wood were found on the surface, outside surface, and they were removed, and there was no impact on the liner. Next slide.

Here I have just summarized the degradation root cause. Industry has operating experience, as has been mentioned before. The root cause is identified as foreign objects behind the liner. Beaver Valley has also concluded that the construction imperfections of the wood behind the liner has created the corrosion. And the Staff also believes that the foreign objects are the root cause of the through-wall corrosion. However, additional visual and volumetric examinations planned by the applicant will provide additional insight regarding the potential corrosion mechanism in the liner.

MEMBER RAY: Okay. Excuse me. Now, this is kind of a generic conclusion, which I think is very, very helpful to me, at least. Yesterday, we were looking at a different containment design, one that had a very -- cork they called it. I don't really know what it was, but, anyway, the liner was protected by a very extensive cork layer, so there was no concrete in contact with the steel. Yet, on the other hand, it's protected against moisture intrusion by a moisture barrier. Is the conclusion that you would draw here that that moisture barrier is important to keep the moisture out of the cork, and, thereby, not in contact with the steel? I'm trying to differentiate now. I realize I've gone off, not talking about Beaver Valley now.

MR. ASHAR: I was present in yesterday's presentation.

MEMBER RAY: I understand, but yes?

MR. ASHAR: I was present in yesterday's presentation, and I understand the discussion that went on with the SEIS. And there are -- most of the concrete plants, I mean, reinforced concrete as well as simple concrete, the moisture barrier as between the liner and the concrete, fill concrete, as they call it. And the -

MEMBER RAY: He's agreeing with you.

MR. ASHAR: Yes. I thought it was some problem with hearing me, what I was saying.

MEMBER RAY: I don't want to take too much time on this.

MR. ASHAR: No, no.

MEMBER RAY: This was a generic issue here. Go ahead.

MR. ASHAR: Yes. This has happened in number of plants, the corrosion of liner at the interface between the liner and the concrete has happened in number of other plants. All have some type of a cork material underneath that moisture barrier. Okay. Moisture barrier has been found effective. Now, there are new formulation of moisture barriers, which are much better than the old one, which do not degrade with time as badly as today's moisture barriers. And they found in each case that I looked at, they found the corrosion only in the area where the moisture barrier was degraded, so it came out of pieces cracked up, and then the water went in.

And they also inspected the area underneath that, where the cork is there, and they don't find corrosion in that area.

MEMBER RAY: Okay. Like I say, I've taken us off on a tangent. I apologize.

MR. SHEIKH: Yes, so the mechanism I have only put on the slide is where the through-wall corrosion took place. The other corrosion which are like the cork material, I didn't put in this slide.

MR. HOLIAN: Yes. This is Brian Holian, Director of License Renewal. So, we're talking degradation from water on the inside with the moisture barrier that we saw yesterday, and then on the outside. One thing I will add, though, is - and even TMI was ready yesterday to address that, should that have come up, on their containment design, are they -- would they be more prevalent for wood, or foreign material to be in there because of the location of rebar even. And they do not believe -- certain containment designs do not believe that they're as prevalent as where the rebar is right close to the liner, in the case of Beaver Valley. So, that's one point I want to bring up. I don't know if that's exactly what you were getting at, but that's one issue that even the Staff is continuing to look at.

MR. SHEIKH: Okay. You know, this slide is a repeat of the applicant sampling plan. The only item that I want to point out is how the 75 samples were selected. It's based on, as we address in the last meeting, on the EPRI report, and if the -- and there was some discussion, what happens if there's a failure, so there is a simple equation with which you can increase the number size, number of samples. For instance, if you have a failure of one sample, the size goes to 110. If you have two, it goes to about 142, and then you can continue on. So, that is the only part on this slide. The other is just a repeat of the applicant.

This slide just tabulates what the applicant explained. Basically, there are two types of findings of the UT examination. One, there is 100 percent loss -- 10 percent loss of liner thickness. What will happen? And the first part, the first thing we're going to do is to perform, as we understand, there will be an engineering evaluation to determine whether there is a statistical failure, which the applicant went through in detail. What is a statistical failure? And if this is a statistical failure, then it will be entered into the corrective action program, and it might -- this will increase the sample size. And there was some questions; what will happen afterwards? So, that same point will be reexamined during the next outage, to see a trend in the degradation. If the loss in thickness is less than 10 percent, you go through the same process as a loss more than 10 percent, only difference is the sample size will not increase.

CHAIRMAN BONACA: The schedule we already heard.

MR. SHEIKH: They already heard the schedule, so we have gone over it.

The next slide, I just listed, we just listed the generic implications of this finding in 2009 at Beaver Valley. The Staff is evaluating the need to issue a supplement to the information notice, which was issued in 2004, to tell the other licensees to look at their plant, and see if there's any applicable actions are required. NRC Office of NRR is going to issue a user need to the NRC Office of Research to investigate the corrosion mechanism in more detail. A new agenda item has been included by the NRC and other industry members in the ASME Subsection IWE meeting to see how we can identify corrosion, and early detection of the corrosion in the liner plate. And changes are being made to the NRC refueling and outage activities baseline inspection procedures to provide additional guidance to inspector concerning containment walkdowns.

MR. HOLIAN: This is Brian Holian, Director of License Renewal, just to add to that slide. I mean, it shows what some of the questions from the ACRS members are also posing. This is a Part 50 issue, and a Part 54 issue. The Staff realizes that. We work together with the Part 50 divisions on this. That's some of the items that you'll see highlighted there. In particular, highlighting the ongoing inspection. We have Region I on line now listening. The inspector who was here during the last outage is here in the audience, but it's that extra piece that we don't always summarize so well for the Committee, that gives an added assurance, as Dr. Powers was going, that ongoing activities, and inspection and enforcement aspects. We'll be looking their corrective action system. Keep going.

MR. SHEIKH: So, that takes us to the last slide, that we -- the Staff has concluded that there is a reasonable assurance that the requirements of 10 CFR 5429 has been met, and the Beaver Valley Units 1 and 2 containment liner plate will comply with the current licensing basis during the period of extended operation. That completes our presentation.

MEMBER POWERS: You've reached a conclusion of reasonable assurance without the benefit of this inspection program that's -- and I wondered how you reached that conclusion?

MR. SHEIKH: We reached that conclusion, as we discussed before, the applicant stated on the basis of his inspection plan.

MEMBER POWERS: So, you have focused in and said okay, the inspection plan, the criterion by which it declares defect, the strategy it has for responding to any findings in that, leads you to conclusion of reasonable assurance.

MR. SHEIKH: Correct.

MEMBER ARMIJO: Doesn't the understanding of the root cause of the problem contribute to your conclusion of reasonable assurance?

MR. SHEIKH: That's part of our evaluation, that we found that the industry operating experience, as well as the applicant's finding, it seems every time there is corrosion, through-wall corrosion, a foreign object was found at the back of the liner. Whether this is sub-atmospheric containment, or atmospheric containment, or a BWR containment, in each case, it was the foreign object, which was there to do the -- have the pitting at the back of the liner.

MEMBER ARMIJO: Right. And I don't disagree with that. Those are facts, observations. The thing that's still -- I'm struggling with is, the moisture issue, where did that water come from? You can have a block of wood. I don't care what the pH is, sitting on a piece of steel for ages, unless you have liquid water somewhere, there won't be any corrosion. So, for this wood to retain that much water for such a long time is puzzling to me, and I wonder if the Staff, or the Applicant can explain where that water came from? Is it -- I've heard a good explanation from Dr. Powers. I'd like to know if the Staff -- so, I think I -- I have an explanation, but I wonder if the Staff or the Applicant have an explanation for that water?

MR. ASHAR: Yes. Earlier in one of the slides, we did mention 13 percent moisture in the wood piece that was given to us by the Applicant.

MEMBER ARMIJO: Sure. That's a measurement.

MR. ASHAR: And where it comes from, the way I would understand is that even in the hardened concrete, there is a water-cement ratio. Now, it starts with a water-cement ratio of .5 to .55, which is very large amount of water. Then, as it dries out, it still has chemically combined water in it, which is estimated as close to .17 or so, water-cement ratio of .17. There is normal moisture still available in hardened concrete, which is separate, and only during the very high temperature cases, or radiation effect, or something like that. But that water-cement ratio stays there, so there's always water there.

MEMBER ARMIJO: So, your belief: it's water from the concrete that is exchanged, or concentrated in the wood -

MR. ASHAR: In the wood, or -

MEMBER ARMIJO: -- over a period of time, and is constantly available to provide corrosion.

MR. ASHAR: That's correct.

MEMBER ARMIJO: Okay.

CHAIRMAN BONACA: We need to move on.

MEMBER BANERJEE: This is going through the wood. Right? I mean, water -- concrete in contact with steel does not cause corrosion. So, is it postulated that this foreign object exchanges water with the concrete and makes it available for corrosion? I mean, is there some such mechanism proven?

MEMBER SIEBER: And lowers the pH.

MEMBER ARMIJO: I've never seen the proof, but it's a -- Dr. Powers has an explanation.

MEMBER POWERS: I would suspect, without knowing for sure, that what happens is, you turn this plant off every once in a while, and the liner cools down quickly. The concrete is still hot, the water migrates up through the wood, saturates it. Then you start the plant up again, and it progressively dries the -- pushes the water back out, and you get a cycling operation there, where the wood is just being delayed in drying out, because it has a certain absorptive capacity, has a certain ion exchange capability that's probably enhanced as explained by treating it with boric acid so it doesn't corrode. So, it brings this water in, precipitates out, the calcium out of the solution makes it -- replaces it with boric acid, makes it acidic. It does a little corrosion action for a while, then dries back out.

MEMBER BANERJEE: So, the mechanism you are postulating is a continuing one.

MEMBER POWERS: Oh, yes. Yes.

MEMBER BANERJEE: If you've got a piece of wood, it's going to continue to corrode.

MEMBER POWERS: Yes.

MEMBER BANERJEE: And it's a progressive -

MEMBER POWERS: Just cycling the pour water of the concrete back and forth.

MEMBER ARMIJO: Which makes finding these foreign objects important.

MEMBER BANERJEE: So it will get more corroded after 40 years, and 60 years, and 30 years. So it's an aging mechanism. Right? In some sense.

MEMBER RAY: I'm sorry. I missed the very first part of what you said, but were you referring to borated water?

MEMBER SIEBER: Or wolmanized wood. When they -- I mean, the suggestion -

MEMBER RAY: But not borated because it was on the inside.

MEMBER POWERS: No, no, no, no. It, as the speaker from Beaver Valley pointed out, it's not -- it was not uncommon in the past to treat construction wood with a little boric acid -

MEMBER RAY: Absolutely.

MEMBER POWERS: -- so the ants and termites didn't chew on it. And that was common.

MEMBER RAY: I thought maybe you were referring to boric acid, which is another non-Beaver

Valley issue that we're -

MEMBER POWERS: No.

(Simultaneous speakers.)

MEMBER POWERS: The BWR people try to straighten them on that, but it didn't work. It didn't take.

CHAIRMAN BONACA: Okay. I think we have -

VICE CHAIRMAN ABDEL-KHALIK: I'm just wondering about the verb "will" in the second bullet. Isn't that a little presumptuous, without knowing the outcome of these inspections?

CHAIRMAN BONACA: I think that they will do whatever they have to do in order to comply. They have to.

MR. HOLIAN: The conclusion - this is Brian Holian, License Renewal. The conclusion includes the 43 commitments in the license renewal SER that they abide by. Part of that is to do those inspections, and the corrective actions for them. It got talked about a little bit by the Licensee just under their normal corrective action process that goes on for any plant, but the correction action program is built into these aging management programs and reviews as a commitment on them to do what they said they were going to do, which is, we find another error, we fix and correct it in accordance with a timely process. So, that's -- the program is the will.

CHAIRMAN BONACA: Dennis, you have to begin to control this meeting. We really have gone out of control.

MEMBER RAY: Only one sentence, Mr. Chairman, if I may. I want to thank you for addressing generic implications here. That's very welcome, from my standpoint. I think we'll need to talk more about that in a different context than Beaver Valley, is my view. And that's all I wanted to say, Mr. Chairman.

MEMBER BLEY: I think at this point, it's time to move on to public comments. And is Mr. Gunter here? You may take the podium. Mr. Gunter is from Beyond Nuclear.

MR. GUNTER: My name is Paul Gunter. I'm with Beyond Nuclear. We're here in Tacoma Park, Maryland, and I want to thank you for your -- for sharing this time with me. I will cut to the chase.

We've been conferring with groups like Citizens Power, and others who share concern, particularly with regard to the containment corrosion problem. And what we find is that there is no reasonable assurance right now, particularly relying on visual inspections, which we believe are not going to give you a reliable, and reasonable assurance of the aging of the containment liner, because it doesn't look at the exterior. It's quite simple, and I know that's been raised to the attention of the Board before, but we're also concerned about the sample size of the UT. We believe that it's way too small for this particular containment. I think we're talking 100,000 square feet, and we're looking at 75 samples of one square foot.

But, more particularly, with regard to new information, we wanted to bring to your attention, basically, a document that was provided to the NRC on July 28th, 2009. This is the supplemental information for review of Beaver Valley Station Units 1 and 2 license renewal application, and it's Amendment Number 39. I draw to your attention on page 4 of 5, there's a commitment, which, basically, speak so the supplement volumetric examinations to be performed at Unit 2 containment liner prior to the period of extended operation. Seventy-five one foot square randomly selected, as described in the FENOC letter, L09205 sample locations will be examined. If degradation is identified, what is deleted here, "the degraded areas will be evaluated and follow-up examinations will be performed to insure the continued reliability of the containment liner", and it's replaced with, "it will be addressed through the corrective action program."

The amendment, I think, highlights what the concern is, is that it highlights that there is no commitment to any age management program for the containment liner, particularly with regard to volumetric UT for the period of extended operation. And we do not share confidence that a patch-as-you-go for the 20-year extension should provide this Committee, or the public, with any confidence that this particular mechanism is being reasonably managed. Thank you for your time.

CHAIRMAN BONACA: Thank you.

MEMBER BLEY: Thank you, Mr. Gunter. Any other comments from the public? I think we had no one else on the agenda.

CHAIRMAN BONACA: We will -- on the schedule here, we have the time for discussion. I think we'll discuss it in the afternoon.

MEMBER BLEY: In the afternoon? That's fine. Then only a half-hour late I return it to you, Mr. Chairman. I thought it was going to be a lot more than that.

CHAIRMAN BONACA: I think we need a break. I know some of you already had it, but we need it. So, let's take a break now until quarter of 11.

(Whereupon, the above-entitled matter went off the record at 10:32 a.m.)

BEAVER VALLEY POWER STATION
License Renewal Application

FENOC Presentation to ACRS

September 11, 2009

Introductions

- Pete Sena, Site Vice-President
- Mark Manoleras, Site Engineering Director
- Cliff Custer, License Renewal Project Manager
- David Grabski, ISI Program Owner
- Site Subject Matter Experts and members of the LRA core team

AGENDA

- BVPS Containment Liner History
- Safety Significance
- Examination Plan
- Conclusion

BVPS Containment Liner History

- 2006 BVPS-1
  - Degradation of concrete side of liner
  - 3 areas of general pitting corrosion
  - 2/3 areas replaced; 3rd area evaluated and monitoring continues
  - Hydro-demolition destroyed definitive evidence of corrosion source

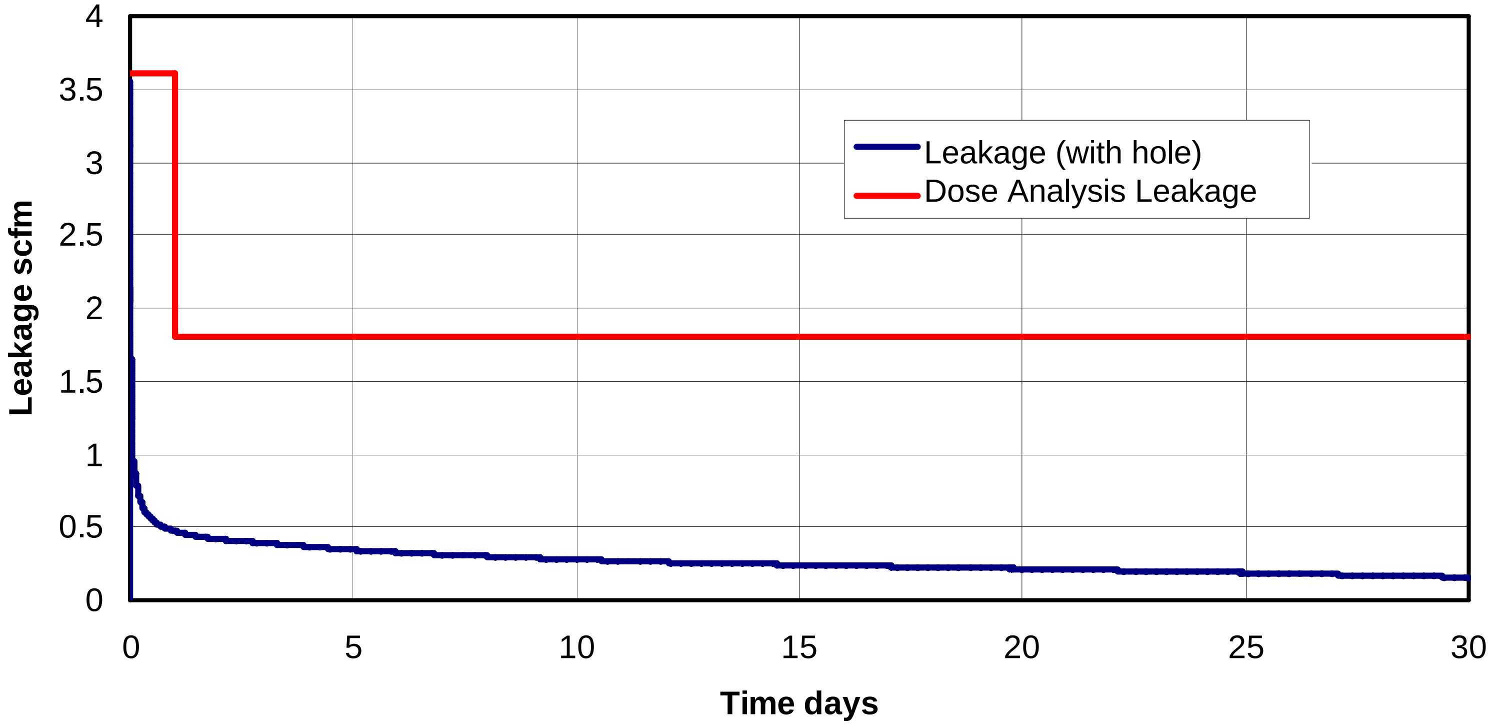
BVPS Containment Liner History

- 2009 BVPS-1
  - One indication noted by IWE visual inspection as an intact paint blister
  - By procedure, required further VT-3 visual examination; which led to volumetric evaluation (UT)
  - Identified 1”X 3/8” thru liner defect
  - Repaired defect and performed baseline volumetric evaluation (UT)

Assessment of Safety Significance

- Assessment of BVPS-1 shows allowable leakage (La) was not exceeded with identified defect; therefore current Dose Analyses remain bounding
- Significant margin exists between actual post DBA leakage and Dose Analysis assumptions due to containment pressure transient
- Margin also exists between Dose Analysis results and regulatory limits
- If a liner defect exists, leakage is limited by concrete
- Safety significance of liner defect is low due to effect of concrete limiting release and conservative assumptions in dose analyses.

Containment Leakage vs. Dose Analysis Assumptions



Examination Plan

- IWE Visual Inspections
- Non-random Examinations
- Random Sample Examinations

IWE Visual Inspections

- Establish condition of the interior liner surface at time of inspection
- Additional IWE visual inspections at BV-1 and BV-2 as defined by ASME code

Non-random Examinations

- Volumetric examination (UT) of liner
- Minimum of 8 locations at each unit.
- Site specific/Industry OE used to identify areas
- BV-1 Five areas; BV-2 three areas
- BV-1 to commence on-line, within the current fuel cycle and completed by December 31, 2010

Non-random Examinations

- BV-1 Areas
  - Repainted more than once
  - Irregular contour
  - 5 feet below the 2006 construction opening
  - At final site grade level
  - Adjacent to 2009 location
- BV-2 Areas
  - Repainted more than once
  - Irregular contour
  - At final site grade level

Random Sample Examinations

- Minimum of 75 random sample locations
- 1’ X1’ sample area of UT accessible liner surface
- Statistical sample failure defined as: >10% material loss due to active pitting corrosion not attributed to fabrication/erection practices.
- Sample plan designed to provide 95% confidence that 95% of the unexamined area are similar

Examination Plan Summary BVPS Unit 1

- <u>IWE Visual Inspection Schedule</u>
  - 2010 Refueling Outage (Additional)
  - 2012 Refueling Outage (Normal Schedule)
- <u>Non-Random Examination Schedule</u>
  - Begin in Current fuel cycle
  - All exams completed by December 31, 2010
- <u>Random Sample Examination Schedule</u>
  - Initial sample consisting of a minimum of 75
  - Initial sample complete by the end of the next 3 refueling outages
  - Evaluate a statistical method to analyze the data to gain additional insight for the general liner condition
  - Document summary of examination plan results
  - Entire random sample plan to be completed prior to PEO

Examination Plan Summary BVPS Unit 2

- <u>IWE Visual Inspection Schedule</u>
  - 2009 Refueling Outage (Additional)
  - 2011 Refueling Outage (Normal Schedule)
- <u>Non-Random Examination Schedule</u>
  - Complete prior to PEO
- <u>Random Sample Examination Schedule</u>
  - Sample consisting of a minimum of 75
  - Commence by end of refueling outage in 2011
  - Evaluate a statistical method to analyze the data to gain additional insight for the general liner condition
  - Document summary of inspection plan results
  - Random sample plan to complete prior to PEO

Conclusions

- Examinations completed prior to PEO and results available for NRC 71003 Inspection
- Liner thru wall defect is consistent with other industry limited OE
- Examination Plan incorporates recent OE
- Examination Plan provides reasonable assurance of liner condition prior to the PEO
- Results of Examination Plan will be shared with the industry.

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Advisory Committee on Reactor Safeguards (ACRS) License Renewal Full Committee

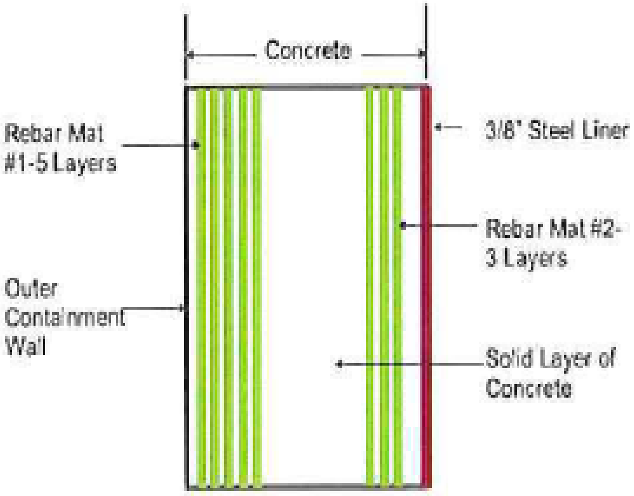
Beaver Valley Power Station, Units 1 and 2 Safety Evaluation Report

September 11, 2009

Kent Howard, Project Manager
Hansraj G. Ashar, Technical Reviewer
Abdul H. Sheikh, Technical Reviewer
Office of Nuclear Reactor Regulation

Beaver Valley Units 1 and 2 Containments

- Steel lined reinforced concrete containment
- Diameter: 126 feet
- Concrete shell: 54 inches thick with 8 layers of rebars
- Liner plate
  - 3/8 inch thick
  - Continuous leak tight membrane
  - Anchored to the concrete shell
  - Not designed as a structural component
- Containment originally designed as sub-atmospheric (5.8 psig)
- Converted to atmospheric containment in 2006



Unit 1 Liner Plate Degradation

- Unit 1 steam generator replacement outage in 2006
  - Corrosion degradation of liner found at 3 areas
  - Two areas replaced
  - One area with minimal loss left in place
  - One area being monitored
- Unit 1 ASME XI IWE inspection in April 2009
  - Paint blister discovered
  - Further investigation revealed a 3/8” by 1” hole in the liner plate
  - 2”x 4”X 6” piece of wood trapped behind the liner plate
  - Non-structural spacer rebar also located behind the hole
- Laboratory Analysis of Wood
  - pH: 3.7- aggressive to carbon steel
  - Moisture content: 13%

Industry Operating Experience

- Brunswick Unit 2 - May 1999
  - BWR atmospheric containment
  - 3 holes
  - Leather glove behind one hole
  - Pieces of wood behind two holes
- North Anna Unit 2 – October 1999
  - PWR sub-atmospheric containment
  - ¼ inch diameter hole
  - Piece of 4”x4”X6’ wood behind the liner
- DC Cook Unit 2 –November 1999
  - PWR atmospheric containment
  - 3/16 inch diameter hole
  - Wire brush with wooden handle behind liner

Degradation Root Cause

- Industry Operating Experience
  - Construction imperfections and foreign objects root cause of through wall corrosion of containment liner at North Anna 2, DC Cook 2, and Brunswick Unit 2 plants.
- Beaver Valley Applicant's Finding
  - Piece of wood in contact with liner plate
  - Oxygen replenished thru concrete
  - Low pH of wood in contact with liner plate for 37 years root cause of corrosion.
- Staff Assessment
  - Wood with low pH,13% moisture content, and intermittent supply of oxygen can cause localized pitting and corrosion
  - Occurrence of through wall corrosion is likely due to foreign object (wood) trapped in the concrete against the liner
  - Additional visual and volumetric examinations planned by the applicant will provide additional insight regarding potential corrosion mechanism in the liner

Beaver Valley Commitments

- **Commitments**
  - Volumetric (UT) examination
    - Minimum of 75 locations selected randomly for each Unit 1 and 2
    - Minimum of 8 non-random locations selected based on operating experience
    - Use of appropriate/applicable statistical methods to determine general state of the liner
  - Visual Examination
    - 100% of accessible area during the next scheduled outages
- **Staff Assessment**
  - Random sample size conform with NUREG 1475 and EPRI guidance for 95/95 confidence
  - Increase in sample size in case degradation is detected
  - Non-random locations will be selected based on the applicant's site specific experience
  - Visual examination will supplement UT examination

UT Examination Criteria

- More than 10% loss of liner thickness on concrete side of the liner
  - Perform engineering evaluation for statistical failure
  - If statistical failure, enter into corrective action program
  - Increase sample size to demonstrate 95/95 percent confidence
  - Reexamination during the subsequent refueling outages
- Less than 10% loss in liner thickness on concrete side of the liner
  - Perform engineering evaluation
  - Enter into corrective action program
  - Reexamination during the subsequent refueling outages

Liner Examination Schedule

Unit 1

- October 2010: 100% visual examination
- December 2010: On-line UT of non-random samples
- April 2012: Scheduled IWE examination
- January 2016: Complete UT of randomly selected samples during next three refueling outages starting in October 2010

Unit 2

- October 2009: 100% visual examination
- April 2011: Scheduled IWE examination
- May 2027: Complete UT of random and non-random samples

- Applicant will provide a summary of the UT testing results as docketed information to the NRC after each outage

Generic Implications

- Staff evaluating the need for issuing a supplement to Information Notice (IN) 2004-09 to holders of operating licenses or construction permits to review the Beaver Valley Unit 1 operating experience for applicability to their facilities and consider actions, as appropriate.
- NRC’s Office of Nuclear Reactor Regulation to submit a User need to NRC’s Office of Research to investigate the corrosion mechanism.
- A new agenda item was included by NRC and other industry members in the last ASME Subsection IWE meeting to identify early detection methods for liner plate degradation/corrosion.
- Changes are being made to the NRC’s Refueling and Outage Activities Baseline Inspection Procedure to provide additional guidance to inspectors concerning containment walkdowns.

Conclusion

- On the basis of its review, the staff determines that the requirements of 10 CFR 54.29(a) have been met.
- The Beaver Valley Units 1 and 2 containment liner plate will comply with the current licensing basis during period of extended operation.

Containment Leakage

Applicant's Assessment

- North Anna Unit 2 and Beaver Valley Unit 1 containment design similar.
- Liner plate hole diameter:
  - North Anna Unit 2: 0.25 inch diameter
  - Beaver Valley Unit 1: 0.69 inch (equivalent diameter)
- Local leak rate test at North Anna 2 hole: 21 SCFH @45 psi
- ILRT performed previously at North Anna Unit 2 with 0.25 inch diameter hole. Leakage within technical specification requirements (<0.1% leakage/day)
- Leakage rate from North Anna Unit 2 extrapolated for Beaver Valley Unit1.
- Beaver Valley Unit 1 leakage rate within plant technical specifications requirements (<0.1% leakage/day)

Staff Assessment of Leakage

10 CFR Part 100/50.67 Compliance

- Applicant's extrapolated leakage for Beaver Valley Unit 1 from North Anna Unit 2 is acceptable because:
  - Leakage limit of 0.10 percent per day is for the containment system
  - Beaver Valley 1 and North Anna 2 plants have identical configuration and design
  - 54 inch thick concrete is a part of the containment system and provides significant resistance to leakage
  - Total leakage thru the hole when added to the previous leakage determined during ILRT in 2006 less than 0.10 percent per day.
  - Local leak rate test at the hole could have buckled the liner and adversely affected the integrity of the containment.
- Beaver Valley Unit 1 remained in compliance with current licensing basis with 0.69 inch equivalent diameter hole in the liner.

Staff Assessment of Leakage

ECCS NPSH

- No significant effect

Large Early Release Frequency (LERF) Assessment

- NUREG-1765 Guidelines for LERF
  - Leakage Volume: 100% of containment volume per day screening criteria
  - Hole size for Large Dry containments: 2.5-3.0 inch with un-obstructive flow thru the liner/steel