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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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PLANT LICENSE RENEWAL SUBCOMMITTEE

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TUESDAY

JULY 10, 2012

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 1:30 p.m., Gordon R. Skillman, Chairman, presiding.

SUBCOMMITTEE MEMBERS:

GORDON R. SKILLMAN, Chairman

J. SAM ARMIJO, Member

DANA A. POWERS, Member

MICHAEL T. RYAN, Member

WILLIAM J. SHACK, Member

JOHN D. SIEBER, Member

ACRS CONSULTANTS PRESENT:

JOHN J. BARTON

MARIO BONACA

NRC STAFF PRESENT:

KENT L. HOWARD, Designated Federal Official

GARRY ARMSTRONG, JR., NRR

RAJENDER AULUCK, NRR

SHANNON BERGER, NRR

ANGELA BUFORD, NRR

RICH CONTE, NRR

ARTHUR CUNANAN, NRR

JOHN DAILY, NRR

CLIFF K. DOUTT, NRR

ALICE ERICKSON, NRR

BART FU, NRR

MELANIE GALLOWAY, NRR

BRIAN HARRIS, NRR

ALLEN HISER, NRR

BRIAN HOLIAN, NRR

WILLIAM HOLSTON, NRR

MATT HOMIACK, NRR

NAEEM IQBAL, NRR
ATA ISTAR, NRR
BRYCE LEHMAN, NRR
JAMES MEDOFF, NRR
KENNETH MILLER, RES
SEUNG KEE MIN, NRR
MIKE MODES, Region I Inspection Team Lead*
DENNIS MOREY, NRR
CHING NG, NRR
DUC NGUYEN, NRR
ALOYSIUS OBODOAKO, NRR
JACOB PHILIP, NRR
PAT PURTSCHER, NRR
BILL RAYMOND, Region I, Senior Resident Inspector at Seabrook*
BILL ROGERS, NRR
ABDUL SHEIKH, NRR
ROBERT SUN, NRR
JOHN TSAO, NRR
MARIELIZ VERA, NRR
JOHN WISE, NRR
MARK YOO, NRR

ALSO PRESENT:

OGUZHAN BAYRAK, University of Texas

BRIAN BROWN, NextEra   RONALD CAMPO, NextEra

ED CARLEY, NextEra

KEN CHEW, NextEra

RICK CLICHE, NextEra

MICHAEL K. COLLINS, NextEra

JIM CONNOLLY, NextEra

CLIFF CUSTER, FENOC

DAN DORAN, Exelon

MICHAEL GALLAGHER, Exelon

STEVEN HAMRICK, NextEra

LEE HANSEN, NextEra

GENE KELLY, Exelon

RUSSELL H. LIEDER, NextEra

HENRY W. MENTEL, NextEra

JAMES MORAN, MPR Associates

RICK NOBLE, NextEra

MICHAEL O'KEEFE, NextEra

MICHAEL OSSING, NextEra

A. THOMAS ROBERTS, MPR Associates Inc.

DAVID ROBINSON, NextEra

DAVID SHAFER, Ameren (Zempleo)

JOHN SIMONS, MPR Associates Inc.

KEN SNYDER, NIST

THEODORE P. VASSALLO, JR.

ROBERT VAYDA, MPR Associates Inc.

THOMAS WAECHTER, NextEra

KEVIN WALSH, NextEra

GARY WARREN, STARS

KEVIN WHITNEY, NextEra

*Present via telephone

C-O-N-T-E-N-T-S

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

1:32 p.m.

CHAIR SKILLMAN: Good afternoon. This meeting will now come to order. Ladies and gentlemen, this is a meeting of the Seabrook Plant License Renewal Subcommittee.

I'm Gordon Skillman, chairman of the License Renewal Subcommittee of the ACRS. ACRS members in attendance are Mr. Jack Sieber, Dr. Dana Powers, Dr. Sam Armijo, chairman of the ACRS, and Dr. William Shack. Our consultants are Mr. John Barton and Dr. Mario Bonaca. Kent Howard to my right of the ACRS is the Designated Federal Official for this meeting.

This subcommittee will review the license renewal application for the Seabrook Station and the associated Safety Evaluation Report with open items. Of particular interest to the subcommittee will be the alkali-silica reaction, ASR, issue at the Seabrook Station.

We will hear presentations from NextEra Seabrook representatives, NRC staff and other interested persons regarding this matter. I would like to add that the Region I inspection team lead, Mr. Mike Modes, will participate in this meeting via bridge line.

We have not received written comments or requests for time to make oral statements from members of the public regarding today's meeting. The entire meeting will be open to public attendance. The subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions as appropriate for deliberations by the committee.

The rules for participation in today's meeting have been announced as part of the Notice of this meeting previously published in the Federal Register. A transcript of this meeting is being kept and will be made available as stated in the Federal Register notice.

I request that participants in this meeting use the microphones located throughout the meeting room when addressing the subcommittee. They are asked to please identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

May I ask for confirmation, please, that the bridge line is open? We're going to take about a 120-second pause here and while this pause is in effect I would like to make a brief comment, please.

Probably all of us sitting at this horseshoe have read all or most of the 770-page SER. We've read multiple RAIs, the status report, many of the references, consultants' reports. And I would like to communicate that this meeting while it will have much attention on alkali-silica reaction, that there is much more to this application than simply ASR as alkali-silica reaction is known. So I want this meeting to be balanced and I want all of the topics to be available for discussion so that we don't get swept away by an inappropriate focus on one single item. And I thank you.

As soon as we get the nod I will introduce Brian Holian from the NRC staff. We're good to go. I will now present Mr. Brian Holian of the NRC staff for opening comments. Brian?

MR. HOLIAN: Thank you, Mr. Chairman, and thank you, members of the subcommittee. My name is Brian Holian. I'm the division director for the Division of License Renewal in NRR. And I'll just cover the agenda in some brief opening comments. Then we'll turn it over to licensee for their presentation which will be followed by the staff's presentation.

Just a couple of introductions to start with. I'll introduce the rest of the NRC presenters when we swap positions. But to my left is Melanie Galloway, the deputy director, Division of License Renewal.

And I wanted to recognize one other person at this time, Mr. Rich Conte sitting in the front row. He's in from Region I. He's a branch chief in the Division of Reactor Safety so he'll also be here for questions from a regional perspective as we look at the presentation.

We do have, as you mentioned, Chairman, Mike Modes, the lead inspector who led the inspection who will actually be giving the presentation via the phone when we get to the regional perspective.

Just a couple of opening comments as you've read the application. And Chairman, I appreciate your comments on the balanced look. We think that's appropriate from the staff view also. There's a lot of issues that the staff has covered and of course ASR has been the one in the press. And there will be an appropriate focus on it today, but we agree with you from the staff's perspective there's a lot of issues on any license renewal application.

We have Melanie Galloway to talk about ASR just for a minute as an introduction here. That's appropriate. Melanie was fulfilling the division director role here for about the last 6 or 7 months as I was over on a Research rotation. So I appreciate Melanie keeping the ball going on this application and this review.

One other item I'd like to mention right off as the subcommittee members have seen it, we just -- the Division of License Renewal updated from GALL Rev 1 to GALL Rev 2 last year around this time. And I believe Seabrook will be the last plant.

I know we have Limerick coming in next. Limerick was able to adjust its application to come in with a full GALL Rev 2 reference which means, usually it means less requests for additional information. So I think -- I just wanted to highlight for the subcommittee, you saw many requests for additional information. Some of those were of necessity because the application had been done in GALL Rev 1 and the NRC staff was bringing them up to GALL Rev 2 with many RAIs. So I wanted to highlight that right up front.

On the ASR issue, when I came back from Research one of my first questions was should we be going ahead with this subcommittee at this time, this ACRS subcommittee. We did not have agreement between the staff and the licensee on open items.

Open items -- a reminder -- usually are that. They could either be we don't have agreement or they could be we have agreement but it's not written out yet by the staff. The staff is still reviewing that. You'll see some of that on some of the open items today, that there is a clear path forward.

On the ASR issue the staff still has many questions for the applicant. The applicant does have a conclusion in their slide that they have an effective aging management program that has been submitted. You don't see that conclusion in the staff slides. We are not to that conclusion yet.

So as we head here we foresee that we would recommend a second subcommittee. That will be up to the subcommittee themselves later, but we would recommend that still pending the conclusion of our Safety Evaluation Report. With that let me turn it over to Melanie.

MS. GALLOWAY: Thank you, Brian. A few notes to provide a little bit more context on the ASR issue in particular.

First of all, the presentation by the staff on ASR is going to be limited to the effects and the structures that are described in the license renewal. The information that's already been provided by the applicant is what we're going to be focusing on.

In addition to the license renewal proceeding there is also a lot of work being done out of our regional offices looking at the current issues associated with ASR and operability. That's not going to be the subject of our presentation today. So I just want to make that content appropriately clear.

Also, it's important to note that our

SER was issued on June 8th of this year and that was based on submittals provided by the applicant through March 30th of this year. Since March 30th the applicant has provided a substantial submittal date of May 16th which affects the license renewal information. However, that is continuing under staff review, and so when we talk about the information that we've concluded and what our questions are at this point it is only through the March 30th date. To the extent that we provide additional context and more current information we will appropriately caveat that and let you know that those are early impressions and that our review is continuing.

The applicant in its May 16th submittal did provide a new plant-specific ASR-related AMP. And while we have not completed the review of that as I just noted we are going to be able to provide some early-on observations. And we are doing this because the applicant has included a lot of information about that program in their presentation today. So in order to round out that discussion we will talk about it, but again briefly and only based on preliminary observations.

It's also important to note that this is very much for the NRC staff and informational meeting. Oftentimes when we're coming before ACRS we are able to provide conclusions. When it comes to ASR, given the state of our review we are really only providing status or information at this time as we know it.

Clearly we know the May 16th submittal as well as additional information. We're anticipating a response to our open items defined in the SE as well as additional responses to questions we will be asking and have already asked on ASR is going to change the context of the staff's review, rightly so. But right now we cannot provide that definition near the tail end of our review as we might in other situations. So this is informational and status-seeking today.

The other point I wanted to make which is important is that the GALL report does address ASR. It defines ASR in a fairly narrow kind of way, for plants that might have a very small indication of ASR or something that was in a realm of what we might consider normal as far as ASR.

The Seabrook situation is well beyond

that and so the GALL when talking about any given effect does indicate that when plant-specific operating experience is beyond what is expected as normalcy and defined as normalcy in the GALL that applicants are expected to go above and beyond and provide more specific information that gets to the actual extent of their plant operating experience. And that's what this applicant is attempting to do and that's what we are doing in our review going forward.

We do understand that the ACRS subcommittee has expressed interest in going to the site in the fall, in particular to see firsthand some of the effects of ASR on the structures at Seabrook. We are aware of that and we are looking forward to coordinating that visit with the ACRS to make that a reality. On that point I'll turn the presentation back over to Brian.

MR. HOLIAN: Thank you. The only thing I'll add before turning it over to the licensee is we did prompt Rich Conte from the region to be ready for any operability calls or any operability-type questions. We realize that an issue like this does cross over, Part 54 license renewal to Part 50.

There is a lot that's probably not even on our slides.

I don't know, I can't remember if we put on there the fact that there is a Region I kind of steering group with both Division of License Renewal presentation and Division of Engineering out of Nuclear Reactor Regulation that looks at the Part 50 type issues of continued operation, you know, up to and before the extended period starts. So that -- Region I has put some focus on that and Rich Conte will be able to speak to that.

With that I thank you and I'll introduce additional NRC personnel later.

CHAIR SKILLMAN: Excuse me, Brian. I'd like to take my nickel back just for a second.

MR. HOLIAN: Oh, sure.

CHAIR SKILLMAN: I want to thank Rich for coming down from Region I. And I want to recognize Dr. Ryan has joined us as part of our team here on the subcommittee.

MEMBER RYAN: Thank you very much.

CHAIR SKILLMAN: Back to you. Thank you.

MR. HOLIAN: With that I'll turn it over

to the licensee and a relatively site vice president, I understand, Kevin Walsh at Seabrook. So, Kevin.

MR. WALSH: Thanks, Brian. Good afternoon. My name's Kevin Walsh. I'm the site vice president at Seabrook and today we're here and I'm happy to be able to discuss the status of our license renewal application. And I'm going to turn it over to members of my staff here shortly but I'd ask that they each introduce themselves.

MR. CONNOLLY: Jim Connolly. I'm the site engineering director.

MR. COLLINS: Good afternoon. Mike Collins, design engineering manager.

MR. OSSING: Good afternoon. Mike Ossing, engineering programs manager.

MR. O'KEEFE: Mike O'Keefe, licensing manager.

MR. NOBLE: My name's Rick Noble. I'm the manager of special projects.

MR. CLICHE: And I'm Rick Cliche, the license renewal project manager.

MR. WALSH: Thank you, gentlemen. At NextEra Energy we have a nuclear excellence model, and the nuclear excellence model essentially outlines the framework of our culture. And one of the primary attributes in that nuclear excellence model is a deep respect for nuclear safety. And we take that very seriously and we apply that to all that we do.

And I would like to say that our staffs work very diligently to put together a comprehensive analysis to support license renewal at Seabrook and look forward today to being able to answer the specific questions on all the topics. So we're here prepared to discuss all the open items and I'll turn it over to Rick Cliche.

MR. CLICHE: Thanks, Kevin. Good afternoon. Again, I'm Rick Cliche, license renewal project manager for NextEra Seabrook. And we've got the Seabrook Station team here today to discuss a little bit about the station, give you some background on the station and to -- some background on how we prepared the license renewal application, and thirdly to discuss the open items. And to get us started Jim Connolly will be talking on the station background.

MR. CONNOLLY: Thank you, Rick. Just

for your information Seabrook is located in the town of Seabrook, New Hampshire. We're approximately 2 miles west of the Atlantic Ocean and approximately 2 miles north of the Massachusetts state line and 15 miles south of the Maine state line.

Seabrook is a single-unit Westinghouse four-loop pressurized water reactor with a General Electric turbine generator. The reactor is housed in a steel-lined reinforced concrete containment structure which is enclosed by a reinforced concrete containment enclosure structure. The unit is licensed for 3,648 megawatts thermal which yields about 1,245 megawatts electric.

The Atlantic Ocean is the normal heat sink for the plant and there are approximately 1,100 folks onsite including contractors. There are approximately 700 NextEra employees with 400 contractors including security folks. Next slide.

This is a layout of the plant site. I'm going to take you through. I'll start off at the turbine building which is in the center of the picture here. The turbine building obviously houses our turbine generator and houses our auxiliary components to support operation on the secondary side of the plant. In the middle is the containment structure which houses obviously the reactor itself and certain auxiliaries. And just below that is the fuel storage building which houses our spent nuclear fuel and is our primary building for receipt of nuclear fuel.

Just below that is the primary auxiliary building which speaks for itself. It holds our auxiliaries, our pumps, heat exchangers and everything that supports operation of the reactor. And just a little bit left of that is the waste processing building which is used as it says to process the plant waste from generation of power.

Just above that is our control building along with our diesel building. It is one combined building for both. The control room is at the very top of the building, the diesels are at the bottom of the building. And to the top left is our switchyard which is our main interconnection between the electrical side of the unit and the New England Power grid.

And also, at the bottom left is Unit 2 containment structure. Unit 2 was reviewed as part of the scope of this license renewal. There are a couple of common structures. There is one as you can see on the bottom of that is a cooling tower that is common for both Unit 1 and 2, and also there is a common servicewater intake structure for both units.

MR. BARTON: Where on this slide is this electrical tunnel with the ASR?

MR. CONNOLLY: On this slide, the electrical tunnel?

MR. BARTON: Where would it be?

MR. CONNOLLY: Where would it be. It is, if you go where the control --

MEMBER SHACK: Get the mouse.

MR. CONNOLLY: I'm sorry?

MEMBER SHACK: Can you use the mouse? No mouse.

MR. BARTON: We've got it now.

MR. CONNOLLY: Okay. It's in that area where the arrow is just --

MR. BARTON: The containment building?

MR. CONNOLLY: Right between the emergency feedwater building and the control building.

MR. BARTON: Okay.

MR. CONNOLLY: Which is right next to the containment building.

MR. BARTON: Gotcha. Okay.

MR. CONNOLLY: I'm going to briefly go over the licensing history of the plant. A construction permit was issued in 1976. Seabrook went through a three-step licensing process and achieved a full power license on March 15th of 1990 and went to commercial operation shortly thereafter.

In 2002 the operating license was transferred to FPL Energy which later became NextEra Energy. During the period of 2005-2006 the unit went through a couple of power uprates, a stretch power uprate and a measurement uncertainty uprate. And the license renewal application was submitted to the NRC on May 25th, 2010. And the current operating license expires in March of 2030.

I'm going to briefly go over the plant status. The unit is in cycle 15. We completed refueling outage 14 in May of 2011 and the current status of the plant is that the plant has been operating continuously for approximately 260 days. The next fueling outage is scheduled for September 2012 and during that outage we'll be doing some servicewater piping inspections, we'll be doing some inspections of the reactor vessel head underneath the reactor vessel head. We'll be looking at the bottom-mounted instrumentation tubes and that area at the bottom of the vessel, and we'll also be performing a rewind of our main generator.

MR. BARTON: Is there some reason in that outage you can't do an inspection of this containment concrete that's in the annulus that's exhibiting ASR? I noticed that you're putting that off until 2015, that inspection.

MR. CONNOLLY: Can you repeat that question? I'm sorry, I didn't hear it all.

MR. BARTON: Okay. The -- why can't you in this next outage do the inspection that you have planned to do on the containment concrete that has the ASR that's in the annulus area? And I read in your paperwork someplace that you don't have that scheduled until 2015.

MR. CONNOLLY: Rick? This is Rick Noble. He's our special projects manager. Rick can probably answer that better than I could.

MR. NOBLE: So what I think you're referring to is I think what we said we were doing in 2015 was the ultrasonic testing. That was a confirmatory for the steel liner plate. So that's what that date is. As far as looking at --

MR. BARTON: Why can't you do that in 2012? That's my question.

MR. NOBLE: The UT for the steel liner plate?

MR. BARTON: Yes.

MR. NOBLE: It's scheduled for our refueling outage in OR `16. That's what that date is.

MR. BARTON: I understand that. Why can't you do it sooner? I mean we're interested to know if there's any damage -- there is damage on the concrete, containment concrete. We're interested is there any damage on the liner, on the exterior of the liner and that's an answer we're looking for. And I'm asking why can't we -- why do we have to wait till 2015 to get that answer. That's my question.

MR. NOBLE: Ted Vassallo of my staff can probably shed more light on that.

MR. VASSALLO: I'm Ted Vassallo from design engineering. I can respond to your question.

During our last refueling outage in April of 2011 we did similar UT thickness measurements at 120 locations on the containment liner and we found no indication of metal loss. So we are fully confident that there is no corrosion activity on the backside of our liner.

MR. BARTON: Thank you.

MR. CONNOLLY: Okay. And at this time I'm going to turn the presentation back over to Rick Cliche who will discuss some specifics regarding the license renewal project.

MR. CLICHE: The license renewal application was prepared onsite at Seabrook Station. The project team included a number of longtime site employees like myself, individuals from design engineering, system engineering, licensing engineering and licensed plant operators were on the project team.

The project team was augmented by some experienced contractors experienced in the license renewal arena, several plants under their belt. We all learned license renewal through involvement, the NEI license renewal committees and the contractors who were brought in to support the team.

The application was prepared following the GALL, Standard Review Plan, and NEI 95-10 industry guidance. NextEra corporate fleet supported the project, provided us oversight and experienced people for audits, sent members of the team on benchmarking activities to gain knowledge both in preparing the license renewal application and more recently on how to implement license renewal commitments.

We had two quality assurance audits conducted during the development of the application to make sure we were following our processes that had been written down and prescribed. Our technical leads all participated in the -- and had hosted onsite at Seabrook the NEI industry working groups.

Our industry peers, some of them here today, reviewed both our technical reports and the assembled application before we submitted it to make sure we were aligned with the industry standards.

CHAIR SKILLMAN: Rick, is the point that you're making relative to completing this application onsite that it was designed, built and is owned by the site personnel versus the home office personnel 1,200 or 1,500 miles away?

MR. CLICHE: That's correct, Mr. Skillman.

CHAIR SKILLMAN: Thank you.

MR. CLICHE: Scoping activities. We had a very good existing equipment database that was a key source of information for scoping. We pulled the applicable information from it, put it into our relational database, gave us a good starting point for scoping of safety-related and the regulated events.

We followed the requirements of 10 C.F.R. 54 and guidance in NEI 95-10. The non-safety affecting safety was not something that was readily pulled from that database. Using a conservative spaces approach we included in scope the water-filled non-safety systems that are in areas that contain safety-related components.

Having former licensed operators on the team was a big help as you know, here they were able to take the lead and confirm through walkdowns that the plant equipment was in fact in the locations we had determined them to be.

We used commodity groups when the evaluations were best performed by component type rather than by individual component.

CHAIR SKILLMAN: Before going to that next slide let me ask a question. I'm on your safety evaluation page 2-94 and the question has to do with the ASFC, the auxiliary spent fuel pool cooling heat exchanger. And it was found to be installed but not connected. And the verbiage goes on to communicate that it is now fully and completely disconnected and you've done a license change to remove it from your license. Are you having second thoughts after the Fukushima event?

MR. CONNOLLY: Well, that's an excellent question. The Fukushima event certainly highlighted the need to have additional protection in your spent fuel storage pools. And to be perfectly honest with you it's something that we haven't given direct thought to, but certainly with the heightened awareness and the heightened sensitivity with everyone's spent fuel pool that is certainly a factor we will probably take a look at.

CHAIR SKILLMAN: Thank you.

MR. CLICHE: Time-limited aging analysis for scoping. In Seabrook we're fortunate to have a very comprehensive searchable record of our licensing base available to us. We perform keyword searches on the database, make sure we identified any potential TLAAs. We also reviewed the design calculations and interviewed site engineers. We benchmarked potential TLAAs against 19 other applications. We looked at 69 potential TLAAs in the application review, ones of similar design and engineering firms.

For neutron fluents, fluents for the vessel shells and wells was determined for operation to 60 years. We identified and evaluated materials in the extended belt line. The upper shelf energy exceeded the minimum acceptance limit of 50-foot bounce and for pressurized thermal shock the limits are below the allowable screening criteria.

For metal fatigue a cumulative usage factor of 40 years as we evaluated for 60 years based on a cyclic analysis. Environmentally assisted fatigue was evaluated. We looked at locations identified in NUREG/CR-6260 for newer vintage Westinghouse plants. Since then we have committed to determine if these locations are in fact limiting and will age-manage the applicable limiting locations.

CHAIR SKILLMAN: Before changing that slide I would like to ask this question, please. On your safety evaluation page 3-149, approximately the fourth paragraph, the NRC staff writes, "However, it was not clear to the staff that the metal fatigue of reactor coolant pressure boundary program will perform cycle counting, cycle-based fatigue monitoring and stress-based fatigue monitoring for RCPB components, including the environmentally assisted EAF. Furthermore, the metal fatigue of reactor coolant pressure boundary does not provide details regarding the action limits that are set on design basis transient cycle counting or on CUF monitoring activities."

I'd like to hear you speak a little bit about the comprehensiveness of your cycle counting and how we can be comfortable that what you indicate as your current number of cycles is accurate.

MR. CARLEY: Probably I should take that. Ed Carley, license renewal engineer. I was the TLAA lead.

Our current cycle counting and basic cycle counting that we used for evaluation of TLAAs is based on our UFSAR cycles. In addition, we are looking at about an additional 200 points to assist us in those to determine that those cycles are accurate in the overall design.

But we currently cycle-count all our UFSAR points. We evaluate it by extrapolation out to 60 years, those points, and determine that our current design will be met at 60 years for all the locations for CUF.

In the area of environmentally assisted fatigue we have two locations that we will exceed 1.0 when we look at the environmental effects of those locations. We have made a commitment to re-analyze those two locations. And one of the projected methods is to look at the actual cycles that those two locations have received and possibly may have to submit a change to the number of cycles allowed at those two locations if we have enough margin.

CHAIR SKILLMAN: Might you have an opinion of how close to 1.0 your final count might bring you?

MR. CARLEY: Preliminary evaluations that have been done is -- looks like we can maintain the current cycles and based on the severity of the current cycles we have received and the number of cycles we fully expect to be at at 40 years and 60 years. But as of right now when you project out to the maximum we would exceed. So looking at what we expect to be at at 60 years we should be able to be at or below 1 with re-analysis.

CHAIR SKILLMAN: But you used the "exceed" word at least one time so explain a little more about that, please.

MR. CARLEY: I used the word "exceed" as right now is if we were to take the cycles we are designed for, we do exceed. However, if we were to look at the cycles that we would expect to be at at 60 years we should be at 1.0 or below.

CHAIR SKILLMAN: Thank you.

MR. MENTEL: Yes, my name is Henry Mentel. I just wanted to supplement the response given by Mr. Carley.

First of all, as far as cycle counting goes we have counted cycles since the beginning of operations and those records were reviewed in detail by one of our contractors to establish that definitive cycle count of where we are today for most of the major cycles. That's one thing.

The second thing is as far as the two locations mentioned what we propose to do is in the finite elements analysis that was done to establish on the -- for the license renewal those numbers that Mr. Carley mentioned exceeded and obviously the environmental contribution exceeded also, they were able to isolate which particular transients were most contributing to those numbers.

And the intent of the future work to be done before the end of our present license is to redo that analysis and go back and re-benchmark what we've used for those particular cycles, the number of count we used in the analysis and compare it to where we actually are to basically remove some of that conservatism and bring those numbers down to within a cumulative usage factor of 1.

CHAIR SKILLMAN: Thank you.

MR. MENTEL: You're welcome.

CHAIR SKILLMAN: Please proceed. Thank you.

MR. CLICHE: Okay. As Brian Holian had mentioned at the beginning we are one of the last, if not the last plant to be, you know, a GALL 1 applicant. That said, you know, GALL Rev 2 and several interim staff guidance documents have been issued since our submittal of the application. And in this operation -- operating experience has been reviewed and numerous changes proactively made to the application.

So supplements to the application were issued to align with GALL Rev 2 AMPs even before GALL Rev 2 was issued. In some cases for small-bore Class 1 piping, selective leaching, PWR vessel internals, buried pipe and tanks, the E3 inaccessible cables and steam generator tube integrity, and we, you know, continue.

We'll be discussing some open items where there's even more operating experience that we are pulling into our application in response to industry OE.

So this table here represents consistency with GALL Rev 1. There were 43 aging management programs. This includes the recently submitted alkali-silica reaction monitoring program. Twenty-nine of them are existing programs, fourteen are new. And you can see the breakdown of consistency with GALL Rev 1.

MEMBER SHACK: Just on your nickel alloy

program, I'm interested in that. Your head is a low-temperature head. I assume that you have no plans to replace it at this point. Do you still count effective degradation years? You know, that thing that was set up once upon a time, is that something you actually track for the head?

MR. CONNOLLY: This is Jim Connolly, site licensing manager.

MR. MENTEL: Again, Henry Mentel from NextEra Energy. We do on a cycle-by-cycle basis go back and review according to the original criteria the number of degradation years and also the risk factor for the head.

MEMBER SHACK: What number of degradation years are you at now? Do you know?

MR. MENTEL: I'd be guessing. I want to say on the order of six.

MEMBER SHACK: That would seem about right.

MR. MENTEL: Yes. I'm not positive of the exact number at this point.

MEMBER SHACK: And again, in your nickel alloy program you mention a lot of potential means for mitigation. How many of your high-temperature sort of Alloy 182 welds have actually been mitigated in one fashion or another?

MR. MENTEL: Okay. Previously I believe in the last couple of years I don't know exactly which outage. We basically did a predisposition on all our pressurizer nozzles by weld overlay.

MEMBER SHACK: Okay.

MR. MENTEL: Russ can speak to the steam generator.

MR. LIEDER: I'm Russ Lieder, NextEra Energy. I'm the Alloy 600 program owner.

We have mitigated the pressurizer nozzles, all six of those. We've inspected the reactor vessel hot and cold leg nozzles. We found one with an indication that was mitigated in that outage and then we have the upcoming inspections to further inspect.

MEMBER SHACK: But you haven't done any other mitigation on the hot leg nozzles?

MR. LIEDER: Just the one that we found --

MEMBER SHACK: An indication, okay. Now, there was some notion I saw somewhere about weld overlays and you had flaws in those. Those are on the pressurizer?

MR. LIEDER: Those are on the pressurizer when we did those.

MEMBER SHACK: And those flaws were basically hot cracking flaws from the weld?

MR. LIEDER: I'm not particular to the welding area, but they were resolved. They were ground out during the repair process of the weld overlay.

MEMBER SHACK: Okay. You're Alloy 600. How about steam generators?

(Laughter.)

MR. LIEDER: I am also the steam generator program.

(Laughter.)

MEMBER SHACK: Now you have the 600 TT tubes.

MR. LIEDER: That is correct.

MEMBER SHACK: You had some problems with cracking in those tubes back in the early 2000, right?

MR. LIEDER: 2002. Spring of 2002, yes.

MEMBER SHACK: Okay. And what was the final resolution of that?

MR. LIEDER: The final resolution, the root cause, basically there was an issue during manufacturing when they thermally treat the tubes.

MEMBER SHACK: Does that affect all your tubes, or was that a very selective --

MR. LIEDER: This is a very small section -- portion of the tubes. So when they thermally treat the tubes they put a mark on them that they're thermally treated and they send them over for bending. The low-row tubes, then they -- up to row 10 for a mile up because they're 11/16ths tubes, they re-insert into the oven to heat-treat the U-bends. So there was a unique signature with the ones that had the cracking issue compared to a normal thermally treated low-row tube.

Subsequent to that another utility found something in the higher rows. And we did studies to see if there was any susceptibility to our higher rows. We found one tube that may be susceptible and we removed it from service. We didn't find any cracking in a high-row tube, only in the low-row tubes and they have all been removed from service with that particular signature. We have not had an issue with that since.

MEMBER SHACK: Okay. And the last bit of information I could find was that you had 62 tubes plugged for AVB wear. Is that -- I assume that's gone up.

MR. LIEDER: Yes. I have the -- we have a total of 173 tubes plugged in all four steam generators. Of that 96 tubes are plugged for AVB wear since day one.

MEMBER SHACK: Okay and is that a trendable sort of thing? Have your wear rates -- your plugging and wear rates decreased on the AVBs?

MR. LIEDER: Actually over a period of time based on these model generators the number of AVB pluggables go down. And after power uprate we noticed a slight increase which was calculated but we really haven't plugged a lot of AVB wears in the recent outage.

MEMBER SHACK: In recent? Okay. So you did notice an increase in wear though as you did the EPU.

MR. LIEDER: Wear rate.

MEMBER SHACK: Wear rate.

MR. LIEDER: But not the number of pluggables.

MEMBER SHACK: Do you happen to know qualitatively what that factor of increase was?

MR. LIEDER: No, I don't off the top of my head. I'm sorry.

MEMBER SHACK: Okay. Thank you.

CHAIR SKILLMAN: Please proceed.

MR. CLICHE: Okay. Sixty-eight regulatory commitments have been submitted with the license renewal application. Again, this includes the recently submitted commitment to implement the alkali-silica reaction monitoring program and also two commitments made for incorporation of industry operating experience on open-cycle cooling and closed-cycle cooling. So these three recently submitted commitments.

These commitments are entered into a site commitment tracking system. I did also want to point out that implementation plans have been developed and implementation activities are starting to get underway at Seabrook Station including some benchmarking and participation in the industry activities for implementation. So our intention is to have this complete, you know, well in advance of the PEO.

And at this point I'd like to turn the discussion over to Jim Connolly who will discuss SER open items.

MR. CONNOLLY: Thanks. Again, I'm Jim Connolly, site engineering director. As you're well aware after the review performed by the staff in the draft SER that was issued there were seven open items that were identified. I'm going to talk to five of those open items. My counterpart Rick Noble will be talking to item 6 and 7.

Of these open items 1 through 5 we have recently submitted responses to items 1, 3, 4 and 5, and we're currently in the license amendment review process with item number 2.

Item number 1 deals with a steam generator tube integrity, the tube integrity program, and there are really two issues that were addressed on this item.

The first one deals with primary water stress corrosion cracking on the primary coolant side of the steam generator tube-to-tube sheet welds. And the request was to clarify our commitment in that area.

The second issue deals with industry

operating experience, foreign operating experience that was found regarding potential degradation of our steam generator divider plates. Again this was another PWSEC issue that was identified.

And we did have a commitment to inspect these divider plates before PEO. However, that wasn't included in the UFSAR supplement that was provided. So as resolution to both of these issues the application was updated to enhance -- it has been enhanced to clarify the tube-to-tube sheet weld inspection commitment. And additionally, the application commitment to inspect the steam generator divider plates has been added to the UFSAR supplement.

CHAIR SKILLMAN: Before you change this slide a perhaps note of humor or note of seriousness. Safety Evaluation Report page 3-56, next to the last paragraph, communicates that there was an indication in the steam generator C hot leg tube. And the tube was plugged on both the hot and cold leg sides. Is it your practice to plug one or the other but not both?

MR. CONNOLLY: I'm going to let, again, let Russ Lieder, our steam generator engineer, address that question.

MR. LIEDER: Russ Lieder, steam generator engineer. Yes, we plug both sides of the tube.

(Laughter.)

CHAIR SKILLMAN: Thank you.

MR. LIEDER: You're welcome.

CHAIR SKILLMAN: Okay. Please proceed.

MR. CONNOLLY: Thank you. The next open item deals with the pressure temperature limits. The consistency of the methods used to develop the P-T limits, the open issue addresses the methods used to develop the P-T limits in accordance with Appendix G of 10 C.F.R. 50.

This, as I mentioned, we have a license amendment in with the staff that is under review by the staff right now. That amendment requests approval to extend the current curves from 20 to 23.7 effective full power years. And as I mentioned, we're in the process of addressing with the staff and awaiting RAIs from the staff. We expect to be able to address this commitment.

Next open item deals with treated borated water. The NRC has recently issued some staff guidance regarding issues with -- for managing the aging effects of stainless steel structures and components that are exposed to borated water. We recently again updated the application to include components on a one-time inspection program for the entire population of components.

MEMBER SHACK: You've had some cracking in this kind of situation, right? Canopy seal welds?

MR. CONNOLLY: Yes. I'll let Kevin Whitney who is our ISI program engineer address the canopy seal weld question.

MR. WHITNEY: Yes, Kevin Whitney, NextEra Energy/Seabrook in-service inspection. I was actually personally involved in that inspection when that leak occurred. If you could restate your question.

MEMBER SHACK: Just did you ever resolve whether it really was an oxygen problem or a chloride problem? Were samples taken to find out if it was transgranular or intergranular?

MR. WHITNEY: My belief is we did not do that. We just clamped it, sealed the leak.

MEMBER SHACK: Okay. Do you have

problems with chloride cracking? I mean you're fairly near the ocean.

MR. WHITNEY: I would have to defer to my chemistry person.

MR. CONNOLLY: David Robinson is our chemistry manager at Seabrook Station.

MR. ROBINSON: Yes, good afternoon. Dave Robinson, chemistry manager at Seabrook. The only attack that we had from chlorides was on a residual heat removal safety valve pipe where we did have transgranular stress corrosion cracking. And that was due to foreign material that was underneath insulation and it was a wetted surface. And that was mitigated.

MEMBER SIEBER: What's been the history of your condenser tube integrity program? Have you had condenser tube leaks?

MR. CONNOLLY: Yes, I think we certainly have had. I myself am not aware of that history, but Ron Campo of my staff here who can address that issue.

MR. CAMPO: Ron Campo, plant engineering supervisor. Can you please repeat the question?

MEMBER SIEBER: Could you describe the

condenser tube integrity history for the plant?

MR. CAMPO: Seabrook Station has experienced two leaks in its lifetime on condenser tubes. We have titanium tubes in the condenser. Both have been a wear, rubbing against a support plate on there.

MEMBER SIEBER: All right. That's -- that occurred.

CHAIR SKILLMAN: Please proceed.

MR. CONNOLLY: Thank you. The next open item addresses the bolting integrity program. The open item addresses once the seal cap closure is installed and the bolting and the component external surfaces themselves within the enclosure are no longer visible for direct inspection.

Seabrook Station presently has one valve, a check valve, 6-inch check valve on our safety injection system that has a seal cap on it. Our plans as we committed to the -- in our response to the open item was to remove that valve, remove that condition prior to the end of 2014.

CHAIR SKILLMAN: Is that a scheduled event on your work schedule?

MR. CONNOLLY: Yes.

CHAIR SKILLMAN: Thank you.

MEMBER SIEBER: You're going to remove the cap or replace the valve?

MR. CONNOLLY: We're going to replace the whole valve. There was some thought about just replacing and pulling the cap off but we were worried about potentially damaging the integrity of the valve.

MEMBER SIEBER: And it looks like the cap is welded to the valve body as opposed to the head of the valve.

MR. CONNOLLY: That's correct.

MEMBER SIEBER: And so that would be difficult.

MR. CONNOLLY: That's correct.

MR. BARTON: You also had some history on bolting integrity on your primary component cooling water system where you've had bolts corrode and the valve bodies themselves. And you replaced bolts with coated -- with coated bolts. And in one case you painted the -- you had corrosion on the bolting and your fix was to paint the bolting because previous painting of the valve bodies prevented further degradation. My question is you did that twice. At one time you had some corrosion on the valve body so you painted the valve body. Later you had corrosion on the bolts so you went and painted the bolts.

Now, why didn't you paint the whole thing at one time? It just -- what I'm questioning here is your corrective action program and your maintenance practices, all right? And you might not have an answer for that but I'm just questioning your maintenance practices.

And you also have experience with containment building spray heat exchanger bolted connection. You had boric acid leakage. You replaced a gasket. The leakage returned and you had to take it apart and re-torque it. So, and I look at those examples and they're just some examples that were in your literature.

So you know, what I'm asking is what's the, you know, the effectiveness of your corrective action program. Is it a problem there or your maintenance practices aren't right? I'm just worried that one or the other is a weak link here.

MR. CONNOLLY: I'll address that question in part. Our corrective action program is a very robust high-volume low-threshold type of corrective action program. So we, you know, we firmly believe that our corrective action program is in very good shape.

However, the component cooling aspect of your question, I'll have Ali Kadal who was the ECCW system engineer at the time and is presently one of our engineers in the license renewal project.

MR. KADAL: This is Ali Kadal. I'm the mechanical lead for the license renewal project at Seabrook Station. I was also the system engineer at the time for the primary component cooling water system. And I was actually the individual that initiated the two condition reports that identified the two conditions during system walkdown. This was back in I want to say 2001 time frame.

With regards to the corrosion of the 24-inch flange bolting that was actually due to the moisture entrapment between the flange bolting and the insulation. And that was causing corrosion as a result of condensation that was being entrapped between the bolting and the corrosion.

And the condition was corrected by, one, replacing the corroded bolts with coated bolts. And secondly by permanently eliminating the insulation from the location.

MR. BARTON: Okay.

MR. KADAL: So that corrective action was actually effective and eliminated further degradation at that location.

Now, your question with respect to the containment air-handling coolers. Again, that was -- I was the one that flagged it. And since then we have actually painted all the -- again, the cause of it was condensation. No insulation was involved. However, we did paint the valve bodies and body-to-bonnet bolting. And in addition to that some of the flange bolting that was corroding. And that has been effective to the best of my knowledge and every now and then we will do touch-up painting in those susceptible locations, or in those affected locations I should say.

MR. BARTON: Thank you.

CHAIR SKILLMAN: Please proceed.

MR. CONNOLLY: Thank you. The next open item addresses operating experience. The open item requested us to describe the programmatic details used to continually identify, evaluate and use operating experience. And the license renewal application has been updated to document the programmatic aspects of evaluating aging-related OE and is being -- and that is currently being evaluated by the staff also at this time.

CHAIR SKILLMAN: Okay.

MR. CONNOLLY: At this point in the presentation I'm going to turn it over to my counterpart Rick Noble who's going to discuss the remaining two open items.

MR. NOBLE: Thanks, Jim. As Jim said I'll talk to the last two open items. And the very last open item is the one that deals with the ASR issue so we'll get into the ASR discussions on that.

The first one has to do with an ASME Section 11 inspection of the containment liner plate. And specifically we have -- our containment is composed of a heavily reinforced concrete steel structure and it's got the steel liner plate on the inside and it has another heavily reinforced containment enclosure dome that surrounds it. So there's a gap between those structures or an annulus between the two structures.

And historically we have had an

accumulation of up to as much as 6 feet of groundwater and a very limited arc, about 40 degrees around that annulus. And because of that there's the potential that the water could have migrated through the concrete to the backside of the steel liner plate and caused rust. And that's what the open item is addressing.

We do maintain this area dewatered currently. In fact, I looked at a screen print this morning of a video camera we have set up in the annulus to watch this area and it is totally dewatered. And as far as our resolution of this it's really two parts. One is that -- and we already discussed this with an earlier question to some degree, but we did commit to doing confirmatory ultrasonic testing on the liner plate to ensure that there isn't any degradation here. And one of the reasons, probably an answer for your question too is that we have removed the water and we're maintaining it dewatered so there really isn't any potential for continued water.

MR. BARTON: How long that water was in there?

MR. NOBLE: Water historically -- has

been in there since the beginning of operation.

MR. BARTON: It's not an area that anybody ever looks at.

MR. NOBLE: It's accessible but not routinely accessed, right. That's why we have a camera now looking at that. It's groundwater. It's slightly below grade and it's groundwater that's migrated in.

MR. BARTON: So you're dewatering that area how?

MR. NOBLE: We're doing it with a temporary pump but we have a preventive maintenance item that maintains that area dewatered.

CHAIR SKILLMAN: Rick, what other structures have a void or a cavity or a ullage that can fill and not be inspected?

MR. NOBLE: I'm not aware that we've identified any other area that would be similar to this nor am I familiar with any.

CHAIR SKILLMAN: Can you state that this is the only one?

MR. NOBLE: I don't know that I could state that unequivocally but I don't know of any other structure that's similar in design to this.

CHAIR SKILLMAN: I'd like to get that question on the record and get a response back to the ACRS subcommittee. The question is here is a physical area that was permitted to be well-watered.

MR. NOBLE: For a void area between two structures.

CHAIR SKILLMAN: For a long time period. What other similar type below-grade areas may be filled with water or filling with water and are not monitored.

MR. NOBLE: I understand. We'll get back to you on the potential for another similar type configuration that is not monitored that could have water in it.

CHAIR SKILLMAN: Thank you.

MEMBER SHACK: Just coming back to the liner plate, I assume that previous ultrasonic inspection was done after you dewatered the -- and it's been dewatered since. Is that correct?

MR. NOBLE: We would have dewatered it from the initial time. We would have already dewatered it once, that's correct.

MEMBER SHACK: Okay. What's the sequence of dewatering and inspection? I guess that's what I'm --

MR. NOBLE: Ever since we've identified this as an area where the water was standing in we have maintained it in a dewatered state. Previous to that we were not -- we were basically not doing that.

MR. BARTON: But the inspections were done when?

MR. NOBLE: Ted, do you know the answer to that?

MR. BARTON: With respect to watering and dewatering.

MR. NOBLE: I don't have the answer to that, the inspection and dewatering. I don't. A year, year and a half, but I don't know the exact date. We did our IWL examinations in September and October of 2010 and they were dewatered at that point to facilitate those ASME examinations.

MEMBER SHACK: And then you did the ultrasonic measurements on the plate.

MR. NOBLE: Yes. In April of 2011.

MEMBER SHACK: So you only had this on an arc basically, is that?

MR. NOBLE: To about 40 degrees, that's

correct.

MEMBER SHACK: Okay. And that's where the inspection was focused, on that arc? Or you did a --

MR. NOBLE: No, these were random locations throughout the containment liner in support of our IWE examination that occurred during April of 2011.

MEMBER SHACK: Is this one of these EPRI inspections where you randomly select?

MR. NOBLE: No, no. It's an ASME Section 11 examination.

MEMBER SHACK: Okay.

MR. NOBLE: But the confirmatory UT testing that we're talking about doing forward we would not only UT in that vicinity of where the potential is for that water, we're also going to do a 10-degree sample all the way around, every 10 degrees around the containment.

MR. BARTON: Is the ASR in that concrete all the way around, or is it in certain areas?

MR. NOBLE: No, in fact there's some indication of micro cracking in that area where it's been wetted but really the other markers -- we'll talk about this a little later -- but there's potential for ASR there but the other markers for ASR are actually not present.

MR. BARTON: But where there was ASR present I think, is that where you did your UT, behind?

MR. NOBLE: Correct. That's correct.

MR. BARTON: Okay. All right.

CHAIR SKILLMAN: Please proceed.

MR. NOBLE: All right. So again we're maintaining this in a dewatered state. We've committed that we'll do this confirmatory UT testing. And then also as we started to discuss because of the potential, because it has been wetted in the past and the potential for ASR we are monitoring this area for ASR as well. In fact, it's included as a tier 2 monitoring point in our ASR monitoring program which I'll discuss a little bit later. In fact, right now.

The last open item, this is the open item that deals with the aging management of concrete structures affected by alkali-silica or ASR. And at the time of our SER, I think it's already been stated. Melanie stated this earlier that we had not submitted an aging management program for ASR at the time of that SER.

We have since submitted that aging management program. It was submitted on May 16th and it provides the method to manage the ASR effects going forward.

We've also completed an interim structural assessment and that documents the current structural adequacy for where we are right now with this condition. And this interim structural report was submitted under docket to the NRC on May 24th of this year as well. And this analysis used -- I'm not going to get into it in too much detail right now unless there are questions, but it used a conservative bounding approach to demonstrate structural adequacy.

There are data in the industry for small-scale tests that have been done that we applied to Seabrook as well as unrestrained data that we had from some of our core sampling.

We've also initiated full-scale testing programs which we'll talk about in more detail in this discussion. In this presentation for the most part we're going to focus on the monitoring of ASR and the effects of aging since that's what the open item actually is.

Just a very brief background on ASR. Although Seabrook Station is the first domestic nuclear power plant to report signs of ASR it's certainly known in the transportation industry and hydro dams since the nineteen thirties.

And what it is, it's a slow chemical reaction between alkali hydroxides and the cement paste, the Portland cement at relatively high pHs, pHs of 12 and a half or greater. And what happens is these alkalis react with reactive forms of silica in the aggregate and it could be the fine aggregate, the sand, or the coarse aggregate, the stones.

In the case of Seabrook we've determined that it's the metamorphic rock in our coarse aggregate that's the source and in fact it's strained quartz within that metamorphic rock that's the source of the reactive silica.

Now although we used a low-alkali cement which was technology at the time there's obviously enough alkali there in order to sustain the reaction.

The reaction forms on expansive gel and

it's this gel that then puts the tensile stress inside the material and it can cause micro cracking of the aggregate and then that micro cracking can then combine and it can form larger cracks that can extend out into the cement paste. And the gel itself, the ASR gel is hygroscopic. It will absorb water and it will expand as it absorbs water. So that can add to the expansion that you see for ASR.

And that is the main concern with ASR is not so much the reaction itself, the chemical reaction, but it's the expansive nature of it. And that's why it's observed by the cracking and then they actually physically measure expansions in concrete in the transportation industry.

The way we diagnosed ASR, we took core samples in the spring of 2010. These were taken from the Bravo electrical tunnel. And the reason for taking them there is the Bravo electrical tunnel is one of our areas where we do have the highest amount of -- historically of groundwater in-leakage through those -- to those walls. So we picked that area to do our first core bores. These are 4-inch diameter cores that we removed.

We did testing on these removed cores

and they did show a reduction in Young's modulus and petrographic examinations did confirm the presence of markers of ASR in some of the samples. Reduction in Young's modulus is the first thing you would expect to see with mild levels of ASR. It's the first impacted material property on the strain cores.

As a result of this we did an extent of condition. In the extent of condition we did walkdowns of other potentially susceptible areas and we picked the five most susceptible areas. We did additional core bores in those areas. We did, again, it's very localized but we did confirm the presence of ASR in four of those five areas. That was done through petrographic analysis of the samples.

We also did material testing on those removed cores. We found that the compressive strength as would be expected with low levels of ASR were not compromised. But we did see reductions, varying reductions in Young's modulus as you would expect.

MR. BARTON: I have a question. You have a confirmatory action letter. And in your response to it you talked about testing of the cores and you gave compressive strength and whether it's actually increased. And that's also in the literature on ASR. But the NRC has stated that the plant has lost almost 22 percent of its strength because it's been saturated with groundwater for more than a decade. So I'm confused.

MR. NOBLE: I think I can help you on that, Mr. Barton. So, the 22 percent is -- actually it's a number that we reported early on. So when we took the first 12 concrete core samples from the Bravo tunnel we sent those off. The initial compressive tests of those came back. We compared those to cylinder tests that we had done in 1979. And that's what we saw the 22 percent reduction to those cylinder tests.

MR. BARTON: Okay.

MR. NOBLE: Since then we've done extent of condition. We've taken 20 more cores I believe, 20 more cores and from those -- same area in the electrical tunnel but they didn't show any signs of ASR.

And we've done compressive testing at another lab, an independent lab that I believe the

NRC actually witnessed some of that work. And what it showed is that there was no difference in the compressive strength between the cores that showed ASR and the ones that were ASR-free. So the ASR is not affecting compressive strength.

So what we attribute that 22 percent reduction to, it's not really a reduction, there's two things going on. One is that you're looking at cylinder tests versus core tests which there is known to be a 10-12 or more percent difference there potential anyway. And we look at the way the loading was done for the two tests and that would account for the delta.

MR. BARTON: That's what you were comparing.

MR. NOBLE: Right. And so that number got put out there that there's a 22 percent reduction and it's really not correct.

MR. BARTON: Okay.

MR. MODES: Just a question I have. Why is Seabrook alone with -- I'm sure you've asked that question yourself.

MR. NOBLE: I don't know that it is. I mean, I know why we have it. We have it because the aggregates that we chose, we used the tests at the time. The tests at the time were not very good at detecting slow-reactive aggregates and we have a slow-reactive aggregate. The other technology at the time was to use low-alkali cements which we did. We used very low alkali cements. That is also known to not necessarily preclude ASR going forward. So I would say those same conditions potentially exist for other plants as well. It would depend on your local aggregates whether or not they actually were reactive or not.

MR. BARTON: Well, would it also depend upon the ability to dewater their site to keep these things dry?

MR. NOBLE: It may or may not. As you'll see some of our ASR sites don't have anything to do with groundwater. They're above grade. We have signs of ASR on the external surface of the condensate storage tank. One of the pictures that Ted has, we'll actually show you a picture, another area where there's above-grade structures that show signs of ASR distress. So you need 90 percent humidity or greater. You don't necessarily --

MR. BARTON: You've got that where your

plant is located, don't you?

MR. NOBLE: Yes, we do.

MEMBER RYAN: Just to understand it a little bit better, it's not necessarily a wetted 100 percent water condition. It's a 90 percent relative humidity condition?

MR. NOBLE: That's correct. In fact, and I may refer to Dr. Bayrak from the University of Texas here in a minute, but I'll start off a little discussion. I've seen pictures from Houston where there were bridge beams. They're very heavily ASR-impacted and they're on the underneath side of the decking of the bridge. So they're protected from rainwater, they're not in contact with any water, but there's a high enough humidity level in Houston that they're still ASR.

Do you want add anything to that, Dr. Bayrak?

DR. BAYRAK: Well, one thing that's to me the most interesting observation that I had over the years is that we have done some field testing on drilled shaft foundations in Houston, Texas and these are fairly large shafts going into the ground some 40-45 feet, in that range. And by the time we excavated around the drilled shaft foundations to take a look at the cracking condition the portion of the foundation that was exposed to wetting and drying cycles did show visible cracks. The portion that was below grade where it was exposed to all kinds of moisture from the clay environment that surrounded the drilled shaft did not have any visible cracks. So wetting and drying cycles actually do figure into how big those cracks are and how they develop.

MEMBER RYAN: So your expectation then at Seabrook would be if there's footers or other steel structural components that are saturated, in a saturated zone all the time that there would be no effect. Is that what you're saying?

DR. BAYRAK: What I'm saying is that the cracking that we see on the inside of the Bravo electrical tunnel is likely worse than what you would see on the outside of it if you had a chance of excavating the dirt out of there. It's actually not dirt, it's lean concrete is what it is on the backside of it.

MEMBER RYAN: Thank you.

MR. NOBLE: That's actually a good segue

way. I was going to talk about one of the insights is that -- and it's very key to the monitoring program. So, I have -- I'd like to pass this around, but this is a section from one of the cores that was taken from the Bravo tunnel. And I've passed this around at a few different public meetings, but the reason I use this one is this shows the most visible ASR signs of any sample that we've taken. So it's a good -- if you look at this one, this has got the most visible signs. And you'll see that the cracks are truly micro cracks in the aggregate.

But one important insight from this that Dr. Bayrak was just alluding to was this is the exposed surface on the inside of the wall. So the first couple of inches into this would be the cover concrete that's not inside the steel. And I think it's pretty obvious. I'll let you make your own conclusions, but if you look at it you'll see that the cracking is visible, quite visible as you go a couple inches into the material. The deeper you go into the material the less you see the expansion cracks. And that's carried out, and these are 14-inch long cores, as you're going towards the center of the wall.

MR. BARTON: Where's your rebar?

MR. NOBLE: The rebar is 2 inches in. So once you're inside that rebar field you don't see the cracking. This would also be the wetted and dried surface. So you get that alkali flow at that surface. That would also tend to make the reaction greater, but there's two things going on. One, it's free expansion which allows more cracking and then you have that wetting/drying effect. So, the exposed surface is what you can see, but the good news to that is it's also where the worst conditions are going to be. Pass that around.

MR. BARTON: But there's no guarantee that you wouldn't have cracking deeper in because you've got moisture in that concrete that's captured in there, right?

MR. NOBLE: There's no guarantee you would not have it and we've seen it in the cores. But like I said, the extent is less than what you see on the visible surface.

MR. BARTON: But long-term can that chemical reaction go on further in and start affecting and corroding the rebar?

MR. NOBLE: The chemical reaction is going on throughout it.

MR. BARTON: Right.

MR. NOBLE: It's the expansion that's differential between the interior and the outside. So the level of chemical reactions really for the most part occurring are the same except for the little thing I said about the alkali flow at the surface.

As far as the rebar, we have done excavations of rebar. We have seen very good condition of our rebar. It's well passivated. And one of the reasons for that is if you have alkali-silica reaction going on you're looking at pHs in the 12, 12 and a half range. That's very good news for steel corrosion that they're relatively high pHs where the alkali flow is going on.

MR. BARTON: I've seen some ASR-damaged concrete that's actually -- and it's not -- well, you're probably aware of this also. On bridge structures and columns and stuff where it's actually gotten deep into the rebar and has actually started affecting the rebar and that starts expanding. So why wouldn't they see that here eventually?

DR. BAYRAK: One thing that we have to appreciate here is that if you were to take a core out of this wall and slice it much like the sample that's being passed around the nature of cracking is different in the cover concrete. I would refer to those cracks as macro cracks that are visible to naked eye. And what you would find in the structural core, so that would be past the rebar curtain, is micro cracking. You would almost need a microscope to see those cracks.

The reason for that is the restraining or confinement effects that's coming from the reinforcing bar cage that's present. So though the chemical reaction is taking place in the entire volume of concrete, when confined concrete is not able to form wide cracks. And when it isn't, just like it is the case for the cover concrete larger cracks do form.

So the question that you're posing in relation to corrosion is a different one and it's somewhat isolated, or it's a different separate discussion than ASR. ASR is one chemical mechanism that we can discuss and corrosion of the reinforcing steel is another one. And you need conducive conditions for the corrosion to take place. Things like chlorides and so on and so forth.

MEMBER POWERS: I guess I don't understand. The cracking is giving you a net flux of sodium to silicate out of the material. That's why you see the white deposits outside.

DR. BAYRAK: Okay.

MEMBER POWERS: And so you're depleting your base in the macro cracking outside.

DR. BAYRAK: Right.

MEMBER POWERS: So if you have an intrusion into the macro cracking of chloride-contaminated water then that is the driving force for the corrosion of any rebar it encounters. So the two are not separated from each other.

DR. BAYRAK: Well, the discussion on what ASR does to structural integrity is one discussion. Whether the cracking that is a net consequence of alkali-silica reaction, whether that forms or enhances the chance of corrosion that may take place in the reinforcing bars is a separate discussion is what I was trying to say.

And in that regard, one thing that I did see is these pictures. As a matter of fact, I'm going to turn this question over to Ted because he can speak to it directly. I was personally very interested in seeing the pictures of the reinforcing bars of the walls at Seabrook just to see if there was any corrosion or not. And they have in fact excavated some concrete out of there. And Ted can speak to that.

MR. VASSALLO: Yes, we actually have three data points. One of the areas in the Bravo electrical tunnel, we've removed all the cover and we've found absolutely no signs of corrosion on the bar. In other areas where we see the micro cracking we find no evidence of any corrosion going on sub-surface. Typically if the bar starts to corrode you will find rust staining on the outside surface of the wall.

And our third data point is in removing some of the cores from some of the walls we did cut some of the reinforcing steel. And examination of that reinforcing steel showed no evidence of corrosion.

CHAIR SKILLMAN: Please proceed.

MR. NOBLE: The next series of slides --

MEMBER POWERS: I mean, there's -- we're

talking about 40 years from now are you going to be able to say the same thing is the question.

MR. NOBLE: I believe so and we'll be able to monitor it. So I mean, it's not something you'd ever say you'll never have any condition like that. It's something that needs to be continued to be monitored. You need to be aware that there is the potential for it. And our structures monitoring program does take into account as it's required to corrosion of reinforcing steel as one of the key elements that we look for.

MR. BARTON: But ASR continues, it never stops. I mean, as long as the surface is wet it continues to go on. Does it get to a point where it accelerates?

MR. NOBLE: No. I've never seen that in any of the studies. But I think you're correct. As an engineer I don't like to use the words "never" or "always" but I won't say it never stops, but I think you're correct in that the long-term studies, long-term exposures studies have shown the expansion rates just continue and continue and continue.

There is some possibility that if we use low-alkali cement that we could become alkali limited at some point. But I think you're right and I do talk to it in a later slide here, some of the accelerated tests we've done to look at the amount of reactive silica we have left. We still have reactive silica. So I think your statement is correct that we would expect to see this continue for the length of --

MR. BARTON: And that's my concern, that this continues and at some point it.

MR. NOBLE: And it has been seen. You know, there are dams that are, you know, 100 years old that have had ASR progress the entire time.

The next series of slides -- so the next thing we're going to talk about is confinement which we've talked about here a little bit. The confinement of the concrete is important to structural performance with ASR. And we now understand that testing of unrestrained cores, once you remove the cores from that structural context the material testing that you're getting does not correlate to the actual performance of the structure.

This has been very well documented for triaxially reinforced structures, concrete beams for instance. And that the materials test that you get from core removals will give you materials numbers that just do not correlate to the strength numbers when you actually test the structural elements. Next slide.

MEMBER POWERS: The best are figures of merit.

MR. NOBLE: Yes. The next series of slides, these are some -- these are actually beams. These are triaxially reinforced beams at the University of Texas at Austin. These were not done for Seabrook. These are existing beams that the University of Texas had for doing testing, strength testing on ASR, the full-scale beam testing.

And these are very advanced ASR-reactive beams. They've undergone accelerated ASR reaction either through the use of sodium hydroxide added, very reactive aggregates and high temperature and moisture to accelerate the ASR.

But the purpose of showing this is really to -- for a discussion on restrained versus unrestrained expansion. So for all practical purposes chemically you're seeing, chemically and environmentally this beam is seeing the same conditions throughout the whole beam. So the same level of ASR reaction is going on in this beam throughout. But you'll see a very drastic difference in the expansion in the cracks from the restrained versus unrestrained sections of the beam.

So the first picture is just a picture of the surface of the beam. It does show signs of ASR distress as pattern cracking there as well as effervescence from ASR gel on the surface and discoloring. The next slide is the same beam but as you can probably see the ends of these beams, the reinforcing doesn't go nearly to the end of these beams. So the end of that beam that you see that's on the support is -- there's no rebar cage inside there. So it's unreinforced.

So this is the same concrete without reinforcing steel with the same level of ASR and you can see the very visible macro cracks in that surface. So again, the purpose of these slides is just to illustrate there is a huge difference between restrained versus unrestrained expansion at the same levels of ASR.

A logical question once you've detected ASR is what's the prognosis for the future. What is it going to do? Is it going to continue to expand? Is it going to stop?

And although there are some accelerated ASR tests that can be used and we've done some of those, they can provide some insight on the amount of reactive silica you still have. But the rates that are obtained from these tests do not correlate to actual rates that are seen in in situ structures.

The reason for that is in order to get the accelerated ASR you're really putting these under very severe exposure conditions and you're varying all the variables at once, temperature, sodium hydroxide. You also have unrealistic specimen preparation for the mortar bar test. You grind the coarse aggregate into sand and then that's what's actually reacted in the mortar bar test.

Again, these tests were conducted with a lack of confinement so you're seeing unconfined expansion. So the rates are not usable. However, we did do it -- we did the accelerated mortar bar test on removed aggregate from our Bravo electrical tunnel wall. And we took it from areas where there is clear signs of ASR, some of our worst ASR. We removed that aggregate. And then control samples where there's no signs of ASR. And we did the mortar bar tests on both of those samples to see if there was any difference in the rate of reaction.

And I'd say the only real conclusive thing I can say from that, those results is that we do continue to have reactive silica so we would expect the expansions to continue in the future. The rates are essentially the same. There's very little difference. So there's not much that can be really gained from that.

The gold standard for how you determine whether or not your accelerated test rates could possibly be used to predict rates is you go out and you monitor the actual crack progression in situ or the expansion rates in situ. So that is the way that the tests are run. So we have the ability to go out and actually crack-map and measure the expansion that's occurring in our structures. And that turns out to be the most effective way to determine how fast it's progressing. So as I said, the accelerated tests just don't give you anything that's really usable.

MEMBER SIEBER: If the rate is reasonably constant and you probably have calculated or estimated the rate of progression through the period of time so far which is about 20 years, right? Fifteen years? What condition will it be in at the end of 60 years?

MR. NOBLE: I'm not really prepared to say that because I don't know, we really don't know at what point. Right now we'll be able to make that determination but we've really only done detailed monitoring, crack-indexing, measuring the expansion, we've really only done that, two iterations of that. So I really only have two data points to really make that determination. I can tell you that there's not much difference between those two data points. Six months apart, they're essentially identical. So it's very slow.

MEMBER SIEBER: Well, 6 months is pretty short compared to 60 years.

MR. NOBLE: They usually say about 2 to 3 years of that monitoring in order to get that rate that you're looking for to project.

MR. BARTON: Can you measure the rate of reactivity as it decreases in your silica and your alkali? You've got alkali in the concrete, reactivity in the silica were the two bad guys that with water are reacting. Now, is there a point where the reactivity in the silica just keeps getting less and less, or is it?

MR. NOBLE: Doesn't appear to. And again, I would say that the studies out there don't really show that. If you look at long-term tests they don't really show that.

There's another accelerated test called the concrete prism test which is a little longer term test, it's a year test. Mortar bar tests are 14 days. If you look at the curves for that you will see it's a flattened S curve for expansion rates over time. So it takes a little while to get going and then you have a pretty steady rate and then it flattens off. But the experimenters really attribute that flattened rate at a year to be alkali leaching. So it's an artifact of the test method. In real life they don't see that flattening of the expansion curve.

MR. BARTON: You're saying what we're seeing now in the rate is going to continue at the same rate.

MR. NOBLE: It's likely to continue at the same rate.

MR. BARTON: And we can't stop it. It's just going to keep going for the next 40 years.

MR. NOBLE: Right.

MEMBER RYAN: Is there any condition or evidence that you've found that would say the rate would accelerate?

MR. NOBLE: No. No, but again, you know, to be a little careful with that because the rate's not going to be -- the expansion rate is not going to be constant anywhere in the plant. It's very dependent on in situ conditions, right? So it's dependent on temperature, it's dependent upon moisture. As I said, wetting and drying can affect it. So --

MEMBER RYAN: But given that --

MR. NOBLE: -- in a given area you wouldn't expect it, if the conditions stayed the same you wouldn't expect.

MR. BARTON: If this continues at the same rate does it get to a point where this cover of concrete on the rebar just starts falling off?

MR. NOBLE: I don't believe we would ever see expansions that high but you'll see with our long-term testing. And you know it's a very slow reaction so you're talking decades from now.

MR. BARTON: It took about 10 or 20 years to get to where you are now.

MR. NOBLE: Correct.

MR. BARTON: Probably.

MR. NOBLE: So we do have remediation strategies in our long-term testing that we'll talk about a little bit that would address if we were to get to a point where something needed to be done. But obviously it's not a near-term thing. It would be something that we have some time to plan out how we would address it.

MR. BARTON: The areas that are being affected by groundwater, unless you turn that around, how will that affect the rate of this?

MR. NOBLE: You would expect to see it continue at about the same rate they are now if the groundwater isn't changing. I'm going to talk about mitigation a little bit in a minute. I think I'll answer your question. If I don't, let me know. In fact this next slide is mitigation.

The mitigation strategies, there are mitigation strategies for fresh mixes of concrete that have shown quite a bit of efficacy. Things like fly ash that are added up to 40 percent or more concentrations now in new concrete mixes. You can also do things like lithium is another one. Lithium is very interesting because it's another alkali metal but --

MR. BARTON: That's not really been proven to be effective in the long term, has it?

MR. NOBLE: That's correct. Well, lithium is effective if it's added as a mix because the gel that's formed from lithium is non-expansive. So you still get ASR but you don't get an expansive gel. But the problem with lithium, the reason it hasn't been effective is you can't get it to penetrate the existing structures more than a few millimeters.

MR. BARTON: Right.

MR. NOBLE: In fact, the Federal Highway Administration spent almost a decade I believe studying that, the use of lithium as topical applicants. And they've really come to the conclusion that there really is no efficacy to using that as a topical applicant.

MR. BARTON: Okay.

MEMBER POWERS: But it's a lovely

antidepressant so everybody was very happy.

(Laughter.)

CHAIR SKILLMAN: Rick, let me ask you a question here. You've got about 10 more slides. We're scheduled for a break at 1500. We have people in this room that would probably desire to have that break. Is this a good time to take a few minutes and then we reconvene in 15 minutes? Will that work for you?

MR. NOBLE: This would be a fine breaking point.

CHAIR SKILLMAN: We're going to take a break for 15 minutes. Please come back at 20 after on that clock. Thank you.

(Whereupon, the above-entitled matter went off the record at 3:03 p.m. and resumed at 3:18 p.m.)

CHAIR SKILLMAN: Ladies and gentlemen. And Rick Noble, you were on slide 27 or 28 and we'll ask you to please continue. Rick?

MR. NOBLE: Thank you. I'm going to talk a little bit about mitigation strategies. As we said there are mitigation strategies for fresh mixes of concrete but there really hasn't been any mitigation strategy for existing concrete that's been shown to have any efficacy.

However, stopping groundwater intrusion in the areas where that's what's driving ASR would be a good thing to do but it would not necessarily prevent the progression of ASR. There's several reasons for that.

One of them is, as I said, we see ASR at our site in some areas that are not associated with groundwater. We see them in some of the above-grade areas.

The second issue is that it's not just stopping of groundwater. You actually have to reduce the humidity below 90 percent. So if you stopped groundwater and the areas below grade remained at 90 percent humidity you would not have stopped the ASR reaction.

There's also some indication that we have groundwater flow and that if you stopped the groundwater without drying out the walls you could actually increase the alkali concentration and you may see a short-term increase in ASR. So, although groundwater is a good thing to do to reduce it, it's not necessarily the solution to stopping ASR.

MR. BARTON: The question I've got is one way to try and mitigate this I always thought was if you dry it out you stop the reaction or slow it down.

MR. NOBLE: That's a fact. If you could actually completely dry it out and stay below 90 percent that would work. But that involves like I said not only stopping the groundwater intrusion but making sure that the humidity is not above 90 percent.

MR. BARTON: Take your tunnel, all right? You could dry it out. You could dry out the tunnel, all right? You could also circulate air in there and maintain a humidity that's below 90 percent. Now, I don't know if you want to go through all that effort but you could do that and that should help the tunnel ASR I would think.

MR. NOBLE: We are looking -- we actually looked at that. We actually had a company that came in that does that experimentally, dries out the concrete. I will tell you that it's not as simple -- and these walls are very thick. They are many feet thick. They stay saturated for years.

(Laughter.)

MR. NOBLE: It's difficult to get it completely dry. They do have some techniques. They're very intrusive. They involve drilling a whole lot of holes in the wall.

MEMBER POWERS: I don't think you want to do that.

MR. NOBLE: I'm saying, I mean these are not things we would not consider, but I just wanted to make it clear that not necessarily -- stopping the groundwater isn't a panacea. Stopping moisture entirely is, but stopping groundwater isn't necessarily a panacea because like I said, we do see ASR in areas that have nothing to do with groundwater.

MEMBER RYAN: How confident are you in your site-wide geohydrologic model? Because you know, you can't really consider this kind of problem we're discussing today without really understanding the --

MR. NOBLE: That's an excellent question.

MEMBER RYAN: -- wider environment that it's in. Because you might pump stuff and it might, you know, recharge in a week.

MR. NOBLE: Right. So I'd say we've been -- groundwater has been an issue, aside from the ASR issue groundwater has been something that we've been working on since 1986. We've tried quite a few different things. We've tried drilling holes through the walls and injecting material on the backside.

In fact, some of the material you see -- you have to be careful because some of the staining material you see on our walls is waterproofing material that we injected years ago. That had some -- that helped in some localized areas. It tended to move the groundwater from one location to another.

In some areas where it was a concern we were able to put some dewatering systems in. We put five dewatering systems in. They reduced the hydrostatic head in that area. That does slow the intrusion of groundwater, helps from a cleanliness material condition aspect, but again it doesn't stop it completely or dry it out. It just reduced the inflow of groundwater.

MR. BARTON: Pump too much too fast because you have the Atlantic Ocean in here pretty soon.

MR. NOBLE: So that was his question about the hydrology. We have done a study recently, we've commissioned a study. It's called fade and transport study that details the movement of all the groundwater on the site. And without going into it in too much detail our site's basically carved out of bedrock, it sits on a bowl of bedrock. So most of this groundwater flow is not traditional groundwater flow through permeable ground. This is through fissures in the basalt.

And so it's very dependent on where those fissures are, where the water comes through. And so this fade and transport study essentially maps out where those underground rivers are. So we have some of that intelligence, but still it's not a straightforward or simple problem to solve.

MEMBER RYAN: Just one more hole, that's all we need.

(Laughter.)

MEMBER RYAN: You heard that I'm sure.

MR. NOBLE: That's correct. That concludes what I was going to say about mitigation strategies. I would like to introduce Ted Vassallo.

He's a materials engineer. He's already spoken to a couple of questions but he's in our civil design engineering group. And Ted is going to talk about the structures monitoring program, in particular the aging management program for ASR.

MR. VASSALLO: All right, thanks Rick. I'm Ted Vassallo from NextEra Design Engineering Civil Group. To monitor the aging effects of alkali-silica reaction on concrete our structures monitoring program has been augmented by a plant-specific alkali-silica reaction monitoring program.

This program consists of 10 elements as described in NUREG/CR-1800. The monitoring program is structured according to the guidelines prescribed in ACI-349.3R, structural condition assessment of buildings.

The program includes three action levels which were developed based on ASR guidance. Three documents provided the guidance to us for these action levels.

The first document we used was a report that was published by the Federal Highway Administration. It's titled "The report of the Diagnosis, Prognosis, and Mitigation of Alkali-

Silica Reaction in Transportation Structures."

The second document that we used was a British publication that was issued by the British Institutes of Structural Engineers. It's titled "Structural Effects of Alkali-Silica Reaction: Technical Guidance on Appraisal of Existing Structures."

And the third document that we use was a document prepared by Oak Ridge National Laboratories for the NRC staff in 1995. It's titled "In-service Inspection Guidelines for Concrete Structures in Nuclear Power Plants." Next slide?

ASR is typically detected by inspection of concrete structures by visual observations of pattern cracking and other features of ASR such as secondary deposits or effervescence in the cracks, dark staining adjacent to the cracks which is caused by the ASR gel. And in some locations you can also have the actual ASR gel deposits in the cracks.

There are two parameters that we use to monitor the extent of ASR and the rate of ASR associated with the pattern cracking. One is a combined crack index and the other is the individual crack width. We collect this data and we have formed the baseline with this data and we will use this data for future examinations and measurements that we'll do in the areas that we have assessed.

The evaluation of the structure's condition is completed according to guidelines that we have included in our structures monitoring program in the next slide, please. This table represents that criteria in our structures monitoring program. It's a three-tier criteria with increasing levels of monitoring up to a full structural evaluation. As you can see from the two columns to your right the combined crack index values are identified and the individual crack widths are also identified. So the field measurements are taken and they are then compared to this table and appropriate corrective actions or further evaluations are taken based on this data. Next slide, please?

MEMBER ARMIJO: I have a quick question.

MR. VASSALLO: Sure.

MEMBER ARMIJO: You monitor crack widths.

MR. VASSALLO: Yes.

MEMBER ARMIJO: But not necessarily the

crack lengths.

MR. VASSALLO: Correct.

MEMBER ARMIJO: Why is that?

MR. VASSALLO: Well, the standard that is published in the British standard, in the Federal Highway Administration, the protocol is basically crack width and combined crack index. Based on those parameters or those values different effects then are evaluated against the concrete. So it's not necessarily a length. That's not the protocol that was used in the two standards.

MEMBER ARMIJO: If you look at a structure and you've got this whole number of cracks all have, you know, add up to a certain number of widths. Some of these cracks -- in one structure the cracks are short, in others they're long. Everything has the same crack width index or whatever you call it. It just seems to me that one is a more severe damage than the other.

MR. VASSALLO: Well, I could also say that some of the testing done on ASR-distressed concrete components was based on crack width and crack index. So all the data that's out there for us to do assessments is based on those two parameters and not the length of the crack.

MR. NOBLE: Because we do it on a 20 by 30 grid though it would take into account to some extent the length of the cracks as well.

DR. BAYRAK: The density of cracking is what it would take into account. The reason why typically, if I may, in structural evaluations the focus internationally as you see in the aforementioned documents is placed on crack widths rather than crack lengths is because it's all about what the cracking does to the rebar that would be crossing that crack. And the strain that would be imposed on the rebar would be directly proportional to the width of that crack as opposed to the length of it. And I'm not sure if that makes --

MEMBER ARMIJO: But more rebar would be strained if you had a longer crack of a given width. It would affect more rebar, the longer one.

DR. BAYRAK: And the conclusion wouldn't change. The fact that the maximum crack width you are measuring say is 20 mils or something like this would remain to be a fact. And if along the length of that crack the width of the crack diminishes down to a lesser value and the crack eventually closes say either a foot or, you know, 10 feet away from that maximum crack width location what you're doing is that you're assuming that conservative maximum crack width value to apply to all rebar that's present in that structure. So that's really how the logic goes.

CHAIR SKILLMAN: To what extent is your evaluation dependent upon your knowing the size and spacing of the rebar in the sections where the cracking is occurring?

MR. VASSALLO: Well, the size and the spacing of the rebar is considered when a full structural evaluation is done to look at the capacity versus demand of the concrete element under examination. So that's where it's figured in.

CHAIR SKILLMAN: Are you dependent upon drawings or are you dependent upon construction photographs for that information?

MR. VASSALLO: The original design basis calculations from the AE that designed the plant. And also the original AE rebar detail drawings for the structures. We have all that information onsite and that's what's used for the evaluations.

CHAIR SKILLMAN: Thank you.

MR. VASSALLO: Okay. Next slide, please? This slide illustrates a typical crack indexing grid for monitoring any progression of ASR. This photo shows the west wall of the discharge structure that was taken in June of 2012 during our second crack measurement and crack-indexing campaign.

As you take a closer look at the picture you could see in the corners and at the intersection of the grid lines there are stainless steel pins that have been permanently installed in the concrete. And these are used for the future measurement campaigns.

These lines also are the lines that we use to establish the length where we measure the crack width and sum up the crack width to come up with the cracking index which is the parameter -- one of the two parameters that we use. I would say the review of the data, the preliminary data that I've looked at from the June re-inspection, re-measurement campaign compared to the initial walkdown work that was done approximately 6 months ago, we see no evidence or no suggestion of any change in concrete expansion at the plant.

MEMBER RYAN: Was the slot over on the right cut on purpose to look deeper in?

MR. VASSALLO: Yes. Yes, that is a rustification joint. And a rustification joint is an architectural feature that is added into large walls for architectural eye-pleasing aesthetics reasons. And it just was coincident that the area we selected to do the monitoring, the rustification joint fell in that area.

MEMBER RYAN: It wasn't a monitoring purpose that you installed it.

MR. VASSALLO: No, it just was coincident with the area that we chose on that structure.

MEMBER SIEBER: These cracks, are they in the enclosure building, or the containment building, or both?

MR. VASSALLO: This location is our discharge structure. But we have assessed 131 locations and it did include our containment enclosure building.

MEMBER SIEBER: But what about the containment building itself?

MR. VASSALLO: And we have done crack

indexing and crack measurement on three locations on the containment structure.

MEMBER SIEBER: And there are cracks there also?

MR. VASSALLO: I beg your pardon?

MEMBER SIEBER: There are cracks in the containment building itself?

MR. VASSALLO: And they were screened out based on crack width. They were very small cracks.

MEMBER SIEBER: Now, your biggest concern amongst all these things is going to be the ability of the containment to hold axial pressure, right?

MR. VASSALLO: No.

MEMBER SIEBER: No?

MR. VASSALLO: The containment is probably, and this will probably surprise you a little bit, but of the priority of the buildings the containment building is probably the least potentially impacted by ASR.

And there's two reasons for that. Number one, there's not a good source of moisture there other than the one area that we talked about earlier, the one-sixth area. But the main reason is that that's a heavily triaxially reinforced structure and in heavily triaxially reinforced structures ASR has the effect of making the structure stiffer. So that structure actually -- structural performance will be greater with ASR than it was without ASR.

MEMBER SIEBER: Okay. Well that's exactly the point I'm trying to make is that the real safety feature of the plant as far as containment of the accident debris, you know, pressure, temperature, radioactive products, that's the least affected by this phenomenon.

MR. VASSALLO: That's correct.

MEMBER SIEBER: Okay. And the enclosure building is not subject to high radiation temperatures other than environmental conditions or internal pressures.

MR. VASSALLO: You're correct. And the main --

MEMBER SIEBER: So really what you're looking for is just degradation for the basic integrity of the enclosure building compared to the pressure-retaining function of the containment building.

MR. VASSALLO: Correct. I would agree with that. In fact, it's our non-triaxially reinforced structures that we would have the most concern about.

MEMBER SIEBER: Right. Okay. I'm just trying to put it into perspective for myself.

MR. VASSALLO: Thank you.

CHAIR SKILLMAN: Please continue.

MR. VASSALLO: Okay. That actually concludes my portion of the presentation so I'll turn it back over to Rick.

MR. NOBLE: Thanks, Ted. As Ted explained the aging management program that we developed for ASR uses the best available industry guidance on establishing those action levels. And then the structural evaluations that we do based on that, they're based on very conservative application of existing data that comes from small-scale testing as well as unrestrained samples. So because of the importance of confinement in the actual performance of ASR-affected structures Seabrook has initiated two large-scale testing programs to replicate the critical Seabrook design details, specifically the reinforcing details.

The first of these, both of these are going to be conducted at the Ferguson Structural Engineering Laboratory at the University of Texas in Austin. And the first of these is being administrated by Dr. Richard Klingner and that testing has to do with anchors, with installed anchors. It's being done on large-scale beams and these beams are being aged for ASR but they're using reinforcement details from Seabrook plant basically to design them.

The second large-scale testing, an even bigger effort is some large-scale destructive testing to establish shear and lap splice strength. And this testing also done at the Ferguson Structural Lab is going to be administrated by Dr. Bayrak.

And Dr. Bayrak's spoken a couple of times this morning but I'll introduce him again. And Dr. Bayrak's going to go into a little more detail on that testing that's going to be done at the University of Texas. Dr. Bayrak?

DR. BAYRAK: Thank you, Rick. My name is Ozzie Bayrak and I spoke in the morning a few times. You may be wondering looking at my name how do you get Ozzie out of that. That was my sister in middle school, but maybe I shouldn't go that far back in terms of introducing myself.

As Rick indicated we're currently under contract to be carrying out some really ambitious full-scale testing programs to shed light to the structural implications of ASR at Seabrook. The primary focus of our testing is on shear performance of really reinforced concrete elements that do not have through-the-thickness reinforcement. And the second portion of the testing program focuses on the lap splice performance. And there what we would be looking at is the anchorage properties of reinforcing bars and what ASR does to the rebar anchorage.

A total of nine beams is what we will test as part of the shear testing program. In a similar manner we will test nine beams for the rebar anchorage purposes.

There are three major objectives in each one of these test programs. To begin with we will test the control specimen to evaluate the design margin and that will tell us what kind of an actual margin over the code calculated capacities we would have for those behavioral modes. And effects of ASR would then be evaluated as part of series 1 test specimens. And within the series 1 I try to use a color-coding here ranging from yellow to darker colors.

The first specimen is intended to replicate so to speak most of your ASR condition that is present at Seabrook today. I have been to the plant, to Seabrook, a few times actually to date and I have personally seen these affected areas. I have done my own walkdowns.

And as I was mentioning earlier in the morning, well earlier in the afternoon session I have been involved with quite a few other ASR-related structural test programs. And in my estimation the cracking that I see for the most part at Seabrook I view that as not necessarily at a significant stage. It's a fairly minor cracking is what it is for the most part.

So the first test specimen in series 1 that would replicate that condition and that we would then have increasing levels of ASR damage. What that is going to tell us is that what happens to the original design margin as the ASR damage progresses for the two behavioral modes that I was talking about, the shear strength and the rebar anchorage.

CHAIR SKILLMAN: Let me ask a question here, please.

DR. BAYRAK: Absolutely.

CHAIR SKILLMAN: An hour ago or 45 minutes ago some statements were made regarding the bore samples and the fact that once those samples are removed and tested, even though they show a change in properties because they are samples and are no longer in the host section from which they came the results of that testing are really not representative of the characteristics of that same material when it's in the host location, the location from which it was withdrawn.

DR. BAYRAK: Correct.

CHAIR SKILLMAN: That leads me to think okay, you pull a sample, you cut it up, you do some testing, the data is nice but it's not necessarily representative of the in situ location from which that material came.

DR. BAYRAK: Correct.

CHAIR SKILLMAN: Why should we be comfortable that when you mix a batch and cure it and subject it to load in Texas that it has anything at all to do with what's going on at Seabrook?

DR. BAYRAK: Let me answer that question. The primary reason why you should feel comfortable is that when you take a core out of a structural element what you're doing is that you're picking up a concrete piece and removing it from its structural context. So what you're losing there is the effects of confinement.

CHAIR SKILLMAN: Yes.

DR. BAYRAK: So the materials testing clearly disconnects itself from reality, let's call it, which is the structure.

CHAIR SKILLMAN: That's why I'm asking the question.

DR. BAYRAK: Right. And the specimens that we will make are pretty much full-scale replicas of entire wall sections of Seabrook plant. These are specimens that will weigh tons. And what is going to happen is that as ASR develops in these test specimens the rebar cage that is in there is going to restrain the concrete that's present in the specimens in a manner very similar if not exactly the same as Seabrook. So that is the primary reason why you should feel comfortable.

The second reason why you may feel comfortable is that for each one of these behavioral aspects we're currently in the process of developing some procedures. We're trying to replicate the plant conditions as close as possible. That does include involving local materials from Maine, the coarse aggregate and so on, in terms of the aggregate interlock that feeds into the shear behavior.

We picked up the most important properties of reinforced concrete walls and those properties that are germane to the behavior are being replicated in our testing program. So that is the second reason why you should feel comfortable. Did I answer your question?

CHAIR SKILLMAN: Partly. Let me introduce the idea of why I asked the question. From your report, it's on your page number 17, it's on your major paragraph 5. The development of a credible management program for an ASR-affected structure is a complex process that must take into account a multitude of factors including but not limited to the degree of concrete reactivity, site environment, quality of the reinforcing details, current state of deterioration, reserves of structural strength, consequences of failure, potential for future deterioration, et cetera.

So it seems to me in order for your testing program to be convincing in the matter at hand which is adding 20 years to this license this board needs to know that the test results fully represent the Seabrook conditions.

DR. BAYRAK: Sure they do. Once again, backtracking, I think you're referring to one of my two white papers that I issued to date.

CHAIR SKILLMAN: It is. It is the document that is entitled "The Structural Implications of ASR State of the Art," February 2, 2012.

DR. BAYRAK: Sure, sure. Within the couple of papers that I issued sharing my perspectives on the issue one must note that there is more than the shear and rebar anchorage behavior that's involved in structural performance.

The reason why we're focused on the

shear performance and the rebar anchorage is because those are the most vulnerable behavioral aspects as far as the structural details at Seabrook is concerned. And within there the elements that we're going after replicating are elements in which through-the-thickness reinforcement does not exist. So once again lack of reinforcement in the third direction which cannot restrain the ASR expansion will render the elements that we're testing, you know, very conservative or bounding elements in terms of what we have at Seabrook.

There was earlier a discussion on the containment structure that does have heavy reinforcement and two curtains in addition to the through-the-thickness reinforcement and lack of water and so on. All those conditions render as far as ASR is concerned the containment structure to be the least vulnerable of all the structures that I have personally seen at Seabrook.

So it is for that reason that the specimens that we have in our hands are not directed towards that particular structure but what we're looking at is the walls of Bravo electrical tunnel and places like it. I'm not sure if that helps.

CHAIR SKILLMAN: It helps. Thank you.

MR. NOBLE: Perhaps the next slide that shows the scale of the test specimens will help.

DR. BAYRAK: Right.

MEMBER SIEBER: One question before you change.

DR. BAYRAK: Sure. Yes, sir.

MEMBER SIEBER: You say the most affected parameter is shear strength. And in the enclosure building if you were to have a seismic event the largest force would correspond to the weakest parameter in the building.

DR. BAYRAK: True. That's a true statement.

MEMBER SIEBER: That's right. And so I think that's, to me that's where the vulnerability would be and you have to be able to predict a decline of shear strength and compare that to the seismic capability that you have to have to meet your seismic design requirement in order to say this structure continues to be safe.

DR. BAYRAK: Right. And to that end I'm going to refer back to an interim structural assessment report that was prepared by MPR

Associates that benefitted from the couple of white papers that I issued on the issue. And once again we will see a picture in about 2 minutes or so, depending on how long this discussion goes, not that I'm trying to put a time limit on it.

But what we have done is we started out with a whole range of structures and structural details and so on, and we narrowed it down to issues that we can answer with existing information in the literature. And therein the listed references are far fewer than that, but I have a stack of 150-plus papers in my office that I can benefit from in answering these questions.

We narrowed it down to a couple of items that we could not answer with existing data in the literature credibly, okay? And those are the items that you see here that we're trying to do to provide direct answers for the Seabrook situation.

MR. NOBLE: Just to correct one thing you said, Oz.

DR. BAYRAK: Okay.

MR. NOBLE: Right. So what we did in the interim is we applied some very conservative values. So we didn't have credible values --

DR. BAYRAK: Correct.

MR. NOBLE: -- in some cases for the shear so we use very conservative numbers, like a 40 percent reduction for lap splice and 25 based on small-scale testing which we don't believe is very representative of what we have, but it's very bounding.

MEMBER SIEBER: Probably not.

MR. NOBLE: Right. So we ran the structural analysis in the interim using those very conservative numbers and that's what our current basis for operability is. Obviously that's not where we want to stay. We don't want to stay with those very conservative numbers, hence the testing that's going to give us that detail.

I just want to make sure that it's not that we haven't evaluated it. We've used very --

MEMBER SIEBER: Those numbers are based on seismic events?

MR. NOBLE: That's correct.

MEMBER SIEBER: Okay, thanks.

MEMBER ARMIJO: I had a question. You're going to fabricate those large beams using the same construction practices and materials to the best of your ability representative of the Seabrook structures.

DR. BAYRAK: With one caveat and that is we will be in the business of accelerating ASR which is going to imply --

MEMBER ARMIJO: That's the second part of my question.

DR. BAYRAK: Okay.

MEMBER ARMIJO: How do you accelerate ASR on those test samples and how confident are you that it's representative of the ASR that's affecting the Seabrook structures?

DR. BAYRAK: The way we have done it in the past is the way we will intend to do in the future and that is we actually use sodium hydroxide and fresh concrete mix to be able to accelerate the ASR expansions. What that's going to do certainly -- in the construction of Seabrook sodium hydroxide was not used in the concrete, but certainly neither the committee here nor anybody involved in the process who's got questions on what does ASR mean for Seabrook, I don't think anybody is willing to wait 20 years to get an answer for the current condition at Seabrook. It'll be 20 years too late if that --

MEMBER ARMIJO: So is this a common practice to use a sodium hydroxide mix in the concrete?

DR. BAYRAK: Very much so.

MEMBER ARMIJO: Okay, so that is kind of like your accelerant.

DR. BAYRAK: Very much so. High-alkali cement, sodium hydroxide and reactive aggregates is what will go in the mix. And within there we are -- our initial trial batching involves 10 different mixtures. We're using some of the earlier mixtures that we had used in my laboratory in addition to new mixtures that we're trying out that would more closely replicate the plant conditions with their aggregates and so on. So we're going to have strike a balance between being as similar to Seabrook as possible while developing ASR as quickly as possible.

MEMBER ARMIJO: In the way you fabricate these samples then you will have ASR through-the-thickness.

DR. BAYRAK: Correct.

MEMBER ARMIJO: Whereas in the real life

I thought ASR started from the surface and worked its way in.

MR. BARTON: It's also working internally, isn't it? Yes.

MR. NOBLE: The expansion will be worse on the surfaces but the reaction itself is occurring throughout the whole section.

MEMBER POWERS: Back to the question is that you indicated earlier you're going to import the aggregate from Maine, but that quarry that supplied the aggregate did so 20 years ago. I suspect they have progressed beyond that particular vein where they were mining. How do you know you will have the strained amorphous silica in the aggregate?

MR. NOBLE: Ted's done the research.

MR. VASSALLO: Well, I actually went to the quarry and we obtained samples from the current quarry that Pike Industry uses. And we sent them to our petrographer at SG&H and he compared the mineralogy of the aggregates from -- the aggregates from the Bravo tunnel and the other affected ASR cores in our plant to the mineralogy of the aggregate samples that I collected. And he said that it's basically the same.

DR. BAYRAK: And from a structural standpoint as long as coarse aggregate is reactive in the mix and as long as --

MEMBER POWERS: Yes, I don't have any troubles with that. It's just that areas change as a function of time and you're going in the direction -- I presume the mining is going in the direction they should be getting increasingly crystalline silicates but I don't know. But apparently you've checked. Good.

MR. NOBLE: I also know that these are reactive because the owner of the quarry is also a very large construction company in northern New England. They produce -- they own their own batch plants. They produce a lot of concrete, do a lot of highway work. And they have designed mixes which of course they have to use fly ash or silica fume to prevent/mitigate ASR. So we know they're reactive.

CHAIR SKILLMAN: I'm going to ask Dr. Bayrak if you would move along because we need to give the staff ample opportunity. They've been very --

DR. BAYRAK: Absolutely. Can we go back

one slide?

CHAIR SKILLMAN: -- quiet here, but we need to hear from them.

DR. BAYRAK: Sure. Prior to the extended discussion here I was indicating that various levels of ASR will be covered in our series 1 testing. And if it at a point in time we realize that the design margins that need to be there to maintain the original design basis are not quite there we will then tap into our series 2 test program in which we would then be considering various retrofit strategies that will be proven experimentally prior to their implementation at Seabrook if Seabrook chooses to implement them. Now we can roll the slide.

What you see here is a full-scale reinforced concrete beam test. It's over 27 foot long, about 4 feet deep, 42 inches to be exact, 21 inches into the page. It's part of a previous testing program for another sponsor. It's got nothing to do with Seabrook. And this is an element in which triaxial reinforcement did exist. And in this particular testing our test results show that ASR damage improved the stiffness and the strength of the reinforced concrete beam.

If you were to take cores out of that beam and test them for compressive strength or tensile strength or modulus you would prove to yourself that ASR decreased the material properties but the structural testing did prove the fact that the performance in fact improves.

And the way the setup work is that the orange ramps push the beam up. The blue beams on the top side restrain the beam from moving up. The ramp to your left is the one that was engaged in the second test on this beam. You see the shear crack that formed, and that way we get to evaluate the shear capacity of the beam. And this picture was taken in Ferguson's structural engineering laboratory.

MEMBER RYAN: Is the beam 2 feet square or so, something like that?

DR. BAYRAK: No. If you can go back one slide. In the vertical direction it's 42 inches deep, into the page or along the length it's 21 inches and 27 foot long.

MEMBER RYAN: Okay.

DR. BAYRAK: That was a replica of a

bend cap, bridge bend, as opposed to a wall segment at Seabrook.

MEMBER RYAN: It looks fairly similar to the wall.

DR. BAYRAK: Oh yes, yes.

MEMBER RYAN: Yes, okay. I mean it's not -- the dimensions aren't off in one dimension or another. It's fairly similar.

DR. BAYRAK: Right.

MEMBER RYAN: Okay.

DR. BAYRAK: This is my last slide for the record here. And just to give you an idea as to how the University of Texas work fits in the overall picture here. The box you see at the top is our -- that's the University of Texas. Our emphasis and focus is on shear strength, rebar anchorage and flexural stiffness of the elements.

As I was indicating earlier we will focus on the original design margin. We will correlate the cracking indices with the percent reduction in capacity as it's depicted in that XY plot at the top. And should there be a need to develop a repair strategy we will have specimens at our disposal to develop those repair strategies.

When we conclude our work we will feed a final report to the final structural assessment that will take place which will in turn feed into the aging management program.

If we can animate this slide once. And the way this is going to work is that as Ted explained the plant is monitoring now two cycles of the crack widths and cracking indices. Those will be tapping into our research report and cracking indices will then be correlated to percent reduction in capacity.

And one more animation will take us to a place where if the percent reduction in capacity depending on what it is is going to trigger different levels of action that may range from more rigorous inspections to perhaps having to implement some retrofit strategies. And if Seabrook chooses to implement those strategies they will have experimentally proven strategies available to them at their disposal.

That concludes my portion of the capsule description of what we did at the University of Texas. And with that I will turn the floor over to Rick Noble.

CHAIR SKILLMAN: Thank you.

MR. NOBLE: Thanks, Ozzie. Just a quick conclusion recap. So we continue to operate right now based on our interim structural assessment which demonstrates current structural adequacy. That's docketed in the interim assessment dated May 24th, 2012.

We understand the effects of ASR and we believe we know how to manage them. We've initiated full-scale testing that will be able to quantify the structural implications of ASR using Seabrook-specific details. And that will be rolled into our final structural assessment.

We have completed baseline inspections and we've completed one reinspection interval. And we've developed an ASR-specific aging management program that provides the best means to monitor the progression of ASR, and that's through monitoring of crack indexing and surface expansion.

And that concludes my portion. I'll turn it back over to Rick Cliche for any final comments.

MR. CLICHE: Thanks, Rick. In closing, NextEra Seabrook has incorporated both industry and site operating experience into the application. Programs have been revised and new programs created based on OE.

We submit a response to four of the open items that incorporates recent industry operating experience and we believe that our responses will close those items.

What you heard here is that we identified an unexpected aging mechanism at Seabrook in our concrete structures. We explain the effects of ASR, and the program owner described the aging management program that's monitoring its progression.

So we are looking forward to continuing our support of the staff in its review of the application and closure of the SER open items. Thank you very much.

CHAIR SKILLMAN: Colleagues, any questions before we release?

MR. BARTON: Not on this issue but I've got some other ones.

MEMBER ARMIJO: I've got a question. In reading I believe it's an MPR report. And I read this paragraph that's -- still confused about it.

It says the concrete at Seabrook was not expected to be susceptible to ASR due to the following. The coarse aggregate is igneous rock that passed the ASR reactivity testing used during construction. Two, the low-alkali cement was used, and three, the aggregate passed petrographic examination.

Now, igneous rock is going to be crystalline.

MR. NOBLE: Right. It's not all igneous. It's actually -- the vein that they took it from had metamorphic with strained quartz in it.

MEMBER ARMIJO: So the report wasn't accurate?

MR. NOBLE: It was granite and so it was believed to be the majority of it was igneous rock but there's actually metamorphic rock in there. That's the source of the reactivity.

MEMBER ARMIJO: So that was your source of the -- of the reactivity.

MR. NOBLE: But again it did pass all the tests at the time to look for reactive aggregates. It did pass the tests of the day.

MEMBER ARMIJO: Would it pass the current tests that are used?

MR. NOBLE: I can say unequivocally no because we've run the accelerated mortar bar test using our aggregates and we get accelerations greater than 1 percent in 14 days which is the acceptance criteria. So it would not pass.

MEMBER ARMIJO: Okay. And then the other quick question was if you could just briefly say what are the proven retrofit strategies that you could use if you had to?

DR. BAYRAK: At this point in time I can comment on that at a conceptual level. We would be talking about installing some essentially anchors into the -- to provide the through-the-thickness reinforcement and various forms of it. And that's why -- and we will end up developing those through our testing program. So it's a little premature for me to provide the details of it.

MEMBER ARMIJO: I'm just trying to get a feel that other structures that have been affected by ASR have been retrofitted in some way that's turned out to be successful.

DR. BAYRAK: Sure. But it highly -- there has been repair jobs that I got personally involved with going back to that one drilled shaft example and there we used carbon-fiber-reinforced polymers, but the boundary conditions are so different that you could wrap this material around it.

Over here you have one exposed surface. You would be talking about installing post-installed anchors through the thickness of the wall as one strategy. Obviously we will look into other methods as well, but that's the most logical.

CHAIR SKILLMAN: Okay, John, you had a question?

MR. BARTON: Not on this.

CHAIR SKILLMAN: Okay. Dr. Ryan?

MEMBER RYAN: No, thank you.

CHAIR SKILLMAN: Dr. Powers? Dr. Shack? Dr. Bonaca? Rick and team, thank you very much for a very patient and thorough presentation. You're released and I'm going to ask Brian Holian to bring up his team, please.

MEMBER POWERS: You guys aren't going home yet, right?

(Laughter.)

MR. HOLIAN: Chairman, if you're ready while they're sitting -- to save time I'll start introductions and continue.

CHAIR SKILLMAN: Yes, please.

MR. HOLIAN: Okay, thank you. Once again I'm Brian Holian, Division of License Renewal. We'll progress to the staff's status of their evaluation. I mentioned earlier -- let me start again with the individuals. I'll start from the left to the right across the room.

We have Dr. Allen Hiser who's our senior level advisor for license renewal. Abdul Sheikh who's our senior structural engineer in the Division of License Renewal. We have Rich Conte, he's the branch chief in the Division of Reactor Safety from Region I. And again we have Michael Modes on the phone who was the lead inspector who will be doing that portion of the presentation. And Rich is here to support.

We have Arthur Cunanan who is a project manager assigned to the Seabrook plant. You've seen Arthur recently before I believe on the Columbia application here before the committee. And senior project manager John Daily assisting today. John's got a different plant, South Texas, coming up right now but he's assisting.

I'd also like to highlight just briefly a couple of members of staff in the audience. As usual we have many of our branch chiefs and staff not only from License Renewal but other technical divisions as needed. But a couple of staff that have assisted in particular on the ASR issue, I highlight them because this subcommittee has been delayed 10 months as we've gotten to this point in the SER. So a lot of work has gone on. I appreciate the licensee's presentation but I appreciate the staff here also who have progressed the issue with their types of questions and issues.

A couple of the folks out here if I catch the main members if you'd raise your hand. Bryce Lehman, structural engineer in the Division of License Renewal. Alice Erickson, structural engineer, License Renewal. Ms. Angela Buford over here in this corner. Angela was just onsite 2 weeks ago working with Region I. I think she goes back, is it next week? So the region still doing some onsite time related to this issue, region-led and Angela is our coordinated engineer from here accompanying those trips.

With that I'd just like to briefly

mention, you know, there was a question from the subcommittee about other plants affected. Clearly an issue the NRC staff's been concerned with. We did put an information notice out about a year ago so hopefully you've seen that in your background material. Nobody's raised their hand and volunteered that they have it.

As Melanie mentioned earlier, ASR is an item in the GALL. We do expect a plant that identifies it at their plant to address the latest GALL advice that the staff has on it and make a plant-specific program should they have it.

How will we find that? Well, we'll find that by the regional inspections. Again, we go out before PEO, the period of extended operation and verify that. But the same inspectors who do license renewal inspectors are routinely the Division of Reactor Safety inspectors and they're looking for it under Part 50 processes too. So I wanted to highlight that.

I also wanted to highlight that New Reactors, we interface with New Reactors. Somebody mentioned the question about current standards and so New Reactors is also aware of this issue.

MR. MODES: Is it reported as Part 21?

MR. HOLIAN: Under Part 21, it has not been reported under Part 21. I'll take that for maybe a lookup on why for a significant condition but it has not been. With that I'll turn it over to Arthur Cunanan, project manager.

CHAIR SKILLMAN: Art, welcome.

MR. CUNANAN: Thank you.

CHAIR SKILLMAN: Thank you.

MR. CUNANAN: Good afternoon Chairman and members of the ACRS staff. My name is Arthur Cunanan. I'm the project manager for the Seabrook Station license renewal application. I'm here to discuss the staff's review of the Seabrook license renewal application as documented in the Safety Evaluation Report.

Brian has made introductions of the NRC staff at the table and also there are members of the audience, the technical staff who participated in the review of the license renewal application or at the audits conducted at the plant.

Mike Modes, the Region 1 lead inspector, will be available on the phone line throughout this presentation and will be discussing the results of the license renewal inspection. Mike, are you still available?

MR. MODES: Affirmative.

MR. CUNANAN: Thanks, Mike. I would like to note that this presentation is different from other presentations that you've seen recently related to the license renewal. We will present a different conclusion because the open item related to the alkali-silica reaction, ASR, on concrete structures is a significant issue that may take a long time to resolve.

Seabrook has had four schedule changes. The schedule changes were not all related to ASR. Some were related to the environmental review. In general, if issues do come up for plants going through license renewal the staff will not hesitate to delay the schedule or change it in order to address the issue.

As Brian mentioned, based on the original schedule the Seabrook subcommittee has been delayed 10 months. The last schedule change made the remaining safety to be determined, TBD. The Safety Evaluation Report has seven open items. Most of the open items have responses that the staff are still reviewing. We will quickly go over these open items and focus our attention to the structures monitoring program open item which relates to the alkali-silica reaction of concrete. This discussion will occur towards the end of the presentation.

For the ASR open item we will focus even further to the issues related to license renewal. However, if you do have questions related to Part 50 Rich Conte, our branch chief from Region 1, is present to answer your questions.

Here's an outline of today's presentation. Next slide. This is an overview of the Seabrook Station license renewal application. The applicant has covered most of the points presented in this slide. However, I wanted to mention that the Seabrook is a PWR four-loop design with the original steam generators. Next slide.

The staff conducted audits for the license renewal application during the period shown on this slide. In addition, Region 1 conducted its license renewal inspection as shown. Those inspection results will be presented shortly.

In preparing the Safety Evaluation Report the staff conducted in-depth technical reviews and issued over 219 requests for additional information. As mentioned before the Safety Evaluation Report has seven open items. We'll quickly go over the open items and focus our attention on the structures monitoring program open item which relates to the alkali-silica reaction of concrete. This discussion will occur towards the end of the presentation.

Section 2 of the SER describes the structures and components subject to aging management review. If there are no questions on this slide I will now turn the presentation over to Mike Modes, the Region 1 lead inspector who will discuss the license renewal inspection review. Mike?

MR. MODES: Hello everyone, my name is Michael Modes. I'm a senior reactor inspector and team lead for license renewal in Region 1. Next slide.

The Region 1 inspection in this case consisted of 3 weeks spread out over a month and consisted of four inspectors with a focus primarily on 10 C.F.R. 50.4(a)(2) inspection which is the non-safety affecting safety portion of the rule. And we selected aging management programs for more thorough onsite review.

The team reviewed approximately 19 of 42 aging management programs. We reviewed 10 of 13 new and 9 of 29 existing aging management programs. We generally don't find it useful to review programs that are in existence and are being constantly monitored by the ROP process such as ISI.

The applicant had developed appropriate evaluation reports for their aging management programs that allowed the inspectors to make a full and broad assessment about the applicant's plans obviously except for the ASR issue. Next.

Some of the interesting AMP inspection results, the aging management program. For the buried piping and tanks inspection because NextEra has a good sound understanding, accurate records and full drawings for their buried piping program -- they don't have any tanks within scope -- with the exception of the backfill aggregate size they meet most of the stipulated requirements of GALL Rev 2 as proposed.

And so for the GALL Rev program, the program is structured to reward any buried piping program that most fully implements the cathodic protection. In the case of Seabrook it was noted by the team that the cathodic protection system reports starting in 1993 reflected that the cathodic protection system was not fully reliable until 2007 when a survey found that only 62 percent of the areas surveyed were mitigated by cathodic protection.

During the first quarter of 2009 the cathodic protection program was finally categorized as green or satisfactory, and they voluntarily entered that cathodic protection system into the maintenance rule under 10 C.F.R. 50.65 during that same quarter.

Because the cathodic protection program at the site hasn't been fully implemented during the entire period of operation it is reasonable for the site to propose some digging of buried piping for excavation in order to corroborate both the historical basis and to support the conclusion that they don't have an ongoing program, and that the cathodic protection program is in fact doing its job.

Another situation of interest was lube

oil analysis where the team identified that the lubricating oil and hydraulic fluid samples of a particular charging pump were not being tested for water content despite the pump being water-cooled, and also they identified as they have in other locations not unique to Seabrook that the application change resulted for flow testing to the 2020 version of the NFPA 25 standard for the fire water system. Next slide.

MR. BARTON: Wait a minute. Even though the diesel fuel storage tanks are not buried or located below grade, the diesel generator building, you guys follow up to see if those tanks were ever inspected? Or maybe you didn't. Maybe the applicant can answer that. Have you ever inspected those tanks?

MR. MODES: I looked at all of the tanks that were within scope, the aboveground. I did not look at -- maybe the applicant can in fact illustrate that.

MR. BARTON: Diesel generator fueling tanks.

MR. CHEW: My name is Ken Chew from license renewal group. Yes, we do inspect and clean and UT those tanks.

MR. BARTON: And they have been done. Have you found any indications of any corrosion or bottom-thinning?

MR. CHEW: No. No, we have not.

MR. BARTON: How about the in-scope above-grade tanks, aboveground tanks? Did you guys look at those, Mike?

MR. MODES: Yes, I did. I looked at all the aboveground tanks.

MR. BARTON: Well, I guess it was in your report. Yes, in your inspection report on the fire protection water storage tank had blistered paint and rust, and rust stains, and caulking at tank bottom edge had evidence of cracking and peeling in open areas, at the tank edge area. Did you follow up to see if they've ever inspected that tank bottom for any thinning of the tank bottoms?

MR. MODES: Yes, and they hadn't. They had a plan to do so. I did follow up on the noted conditions, the caulking that was missing, the blistering, some of the rust spots that I noted. The AMP GALL audit that had preceded us had reviewed the same program and it had looked at a number of the historical records. So I was aware of their work on that. I also followed up and looked at about a half a dozen work orders going back to understand how they were mitigating the consequences of that aging effect.

MR. BARTON: Did you guys check to see if that -- the conditions of that tank were listed or in their corrective action program? Did they have that deficiency in their program?

MR. MODES: Yes, those -- the work orders I looked at were a consequence of those conditions being noted in the corrective action program.

MR. BARTON: Okay. Thank you.

MR. MODES: You're welcome. Any other questions?

CHAIR SKILLMAN: Please proceed, Mike.

MR. MODES: Next slide. Obviously the subsection IWL and structures monitoring program was of interest to the team because it constitutes a large issue. There's been a considerable amount of discussion as the regional inspection because it occurred early in this process during a period when Seabrook was essentially in the first phases of discovery. What the team concluded was that it would be necessary for further development to occur and so the team deferred any conclusion about the acceptability of that program. Next slide.

The regional inspection did a large number of walkdowns. I personally did the residual heat removal system in order to understand how some of these aging management program proposals fit into the monitoring of aging of what is a rather safety-significant and risk-significant system. In addition to which one of the team members focused on the non-safety affects safety. And he does that by taking the drawing and trying to understand the three-dimensional relationships that exist in various locations such as the turbine building, the primary auxiliary building, east main steam, feedwater pipe chases, control building, servicewater pumphouse, et cetera. Quite an extensive walkdown.

MR. BARTON: I've got a question on that. On those buildings outside the power block what did your team assess the material condition of those buildings to be?

MR. MODES: Except for those locations

where the ASR, the material -- and those locations such as the residual heat removal vault which are below grade. The condition of the plant is rather -- it's the normal condition of a plant of its pedigree and age.

MR. BARTON: Not good or bad.

MR. MODES: You know, we wrestled. Inspectors who come to talk to you guys wrestle with this question every time.

MR. BARTON: I know. I ask the question every time.

MR. MODES: Yes, I know, and I've been doing this for 13 years with you fellows. The thing is the standard I apply is the plants that I look at. And so for me to answer that question I'm drawing a comparison against plants that are only located in the Northeast. So given that caveat, given that standard this plant is in good condition.

MR. BARTON: I'm not looking for a comparison to all plants. I'm interested in when you guys look at these plants do they pay attention to the outer buildings. Do they really care about the condition of all the buildings, not just the power block which everybody concentrates on and thinks well, that's what's important. I think, you know, the culture at the site also depends on how do you take care of your outbuildings, all right? And that's what I'm looking for.

MR. MODES: We've had this discussion before and it's sort of the Spic and Span standard.

MR. BARTON: Yes.

MR. MODES: Right. So if you -- and I agree with you, especially somebody who's been doing these inspections for 40 years. I think what you're talking about is getting an impression, an impression about the culture of the site --

MR. BARTON: That's right.

MR. MODES: -- based on the physical evidence of how well they take care of the site.

MR. BARTON: Right, exactly.

MR. MODES: And I can tell you that in walking around that site. And again, except for those areas where it's below grade and there's intrusion of water, et cetera, there appears to be what I would call pride of ownership.

MR. BARTON: Okay, that's what I'm looking for. Thank you.

MR. MODES: You're welcome. Next slide.

So some of the observations are that obviously the -- we observed the applicant's initial struggle with the alkali-silica reaction. And we did not, I personally noted water intrusion in the RHR walkdown including a considerable amount of deposits and brown stains from the membrane failure that I believe they referred to earlier. Next slide.

So we concluded that the scoping of the non-safety systems and structures and components and the AMPs were acceptable, and that except for the ASR I believe the inspection results would support a conclusion of reasonable assurance that the aging effects will be managed and the intended functions maintained.

And also the rule requires that the documentation supporting the application be auditable and retrievable, and that is something that we always check. And we found that in fact the documentation in this case is complete and does support the application. That concludes my remarks.

MR. CUNANAN: Thanks, Mike.

MR. MODES: Thank you.

MR. CUNANAN: Now we're going to move onto Section 3 of the SER. Section 3 of the SER covers the staff's reviews of the applicant's aging management programs and aging management review line items in each of the systems which was reviewed against the criteria in the GALL report. I'm now going to go over the Section 3 open items except for the open item related to ASR.

As shown on the table the staff reviewed 42 aging management programs. The staff also reviewed over 6,000 aging management review line items from the submitted license renewal application. Next slide.

CHAIR SKILLMAN: Art, before you change let me ask this question. In two instances on the SER page 3-183 referring to the nickel alloy nozzles and penetrations program, and the SER page 3-188 PWR vessel internals aging program the staff uses the word "may" and here's the example. This is specifically on page 3-188 and this is the PWR internals.

"On the basis of its technical review of the applicant's PWR vessel internals aging management program the staff concludes that the applicant demonstrated that through the use of this AMP the effects of aging of the RVI components may be adequately managed." Emphasis on the word "may."

That shows up also on page 3-183 on the nickel alloy nozzles and penetrations where the staff writes, "The effects of aging may be adequately managed." In almost every other instance the staff writes "will be adequately managed."

Why are those "mays" hiding down in the safety evaluation?

MR. CUNANAN: Well, I think that probably would have been a review that was incorrectly stated. So if we're going to say that it's adequate we will say "will."

CHAIR SKILLMAN: I would suggest you may want to go back through this document and make sure that if you use the word "may" you mean "may" and there is an adequate explanation for why that is appropriate or you may want to change that "may" to "will."

MR. CUNANAN: Yes.

CHAIR SKILLMAN: So there are a number of examples and I would suggest you please find those and correct those.

MR. CUNANAN: We will do that.

CHAIR SKILLMAN: Thank you.

MR. CUNANAN: This slide addresses the bolting integrity program open item. In recent reviews of license renewal applications and operating experiences the NRC staff noted that the seal cap enclosures can contain water leakage and therefore use of such enclosures should be accounted for in the license renewal applications to ensure proper aging management.

The applicant stated that it used a seal cap enclosure to contain water leakage. Seal cap enclosures may prevent the direct inspection of bolting and component external surfaces. It was unclear how components within seal cap enclosures will be age-managed since direct inspection is not possible.

The applicant has subsequently submitted an LRA amendment stating in its UFSAR supplement to remove the seal cap enclosures no later than December 31, 2014. The LRA amendment is still being reviewed by the staff.

This slide addresses the ASME Code Section 11 Subsection IWE program open item. Due to the applicant's previous failure to maintain the annulus space between the containment and containment enclosure buildings in a dewatered state the staff is concerned that the applicant has not until now implemented procedures and inspection requirements to keep the area dewatered in the future. Accumulation of water in the annulus space can potentially degrade the containment liner and accelerate degradation of concrete. The staff is -- the staff determined this is being tracked as an open item. Next slide.

This slide addresses the steam generator tube integrity program open item. This is an administrative item to clarify the applicant's intent and to place the applicant's commitments in the UFSAR supplement. The applicant has since submitted a LRA amendment to clarify its intent on the commitment of the steam generator tube integrity program and included the commitments in the UFSAR supplements. However, the LRA amendment is still under review. Next slide.

This slide addresses the operating experience open item. This is an open item that the ACRS has seen before with Columbia Generating Station. The applicant did not fully describe how it will use future operating experience to ensure that the aging management program will remain effective for managing the aging effects during the period of extended operations.

Operating experience is important because it serves as a feedback mechanism to ensure the continued effectiveness of the aging management program. Appropriate aspects associated with the applicant's activities for the ongoing review of operating experience related to aging should be consistent with the guidance in the final license renewal interim staff guidance LR-ISG-2011-05 titled "Ongoing Review of Operating Experience." Next slide.

This slide addresses the treated borated water open item. The LRA contained several AMR line items that managed stainless steel components exposed to treated borated water for loss of material, cracking and reduction of heat transfer with the water chemistry program.

However, the staff noted that new staff guidance recommends an additional one-time inspection to verify the effectiveness of water chemistry controls in borated water environments. The application has submitted a LRA amendment to include the additional one-time inspections for several AMR line items to manage stainless steel components exposed to treated borated water. The LRA amendment is still under review by the staff.

Section 4 of the SER contains the staff's review of the time-limited aging analysis, TLAA. The following slide presents the open item related to TLAAs.

This slide addresses the pressure temperature limit open item. As part of a separate licensing action on P-T limits the applicant requested approval of P-T limits that would, based on an updated neutron fluents evaluation, extend the operating time of the current curves from 20 effective full-power years to 23.7 effective full-power years.

The staff has had concerns related to whether the methodology used to develop the P-T limit is consistent with the requirements in 10 C.F.R. 50 Appendix G. Because the methodology used to develop the P-T limits during the initial operating period is the same as that used during the period of extended operation this additional information is also pertinent to the review of the license renewal application to resolve this issue as an open item.

This slide addresses the structures monitoring program open item. Based on operating experience related to concrete degradation due to alkali-silica reaction, ASR, the staff is concerned that the applicant's enhancement to the structures monitoring -- aging management program is not sufficient to manage the effects of ASR. The staff is also concerned that the applicant has failed to address the effects of ASR degradation in its concrete containment.

I would like to note that when the SER was issued on June 8th, 2012 and reviewed to the March 30th, 2012 letter, the applicant has submitted an LRA amendment to include a plant-specific ASR monitoring program on May 16th, 2012. However, the staff is still reviewing the information and the evaluation on the May 16th letter was not included in the SER. Later in the presentation the staff will include its initial observation of the ASR monitoring program.

Also, the focus of this presentation is related to the license renewal issues. The applicant has told its story. The staff disagrees with the applicant's presentation because the staff believes that the applicant should address the effects of ASR in concrete containment and the aging management program does not include trending data to determine extent and rate of degradation of mechanical properties from tests.

However, these are the staff's differences today. With the evolving review the staff's position could change with new information received in the future.

The following slides will explain the staff's position related to the ASR issue.

DR. BONACA: I have a question. Why is this being treated as an aging management issue in license extension space and not as a Part 21 in the current situation? I mean, the plant has a problem with aging in the current environment. If the plant was not going for license renewal it still would have to report this issue under normal licensing steps. I mean, Part 21 comes to mind. Maybe I should ask the question to the staff.

MR. HOLIAN: Yes, Dr. Bonaca, Brian Holian again. If I heard the question right it is a question about reporting kind of threshold for the plant, the safety significance of the issue. Is that correct?

DR. BONACA: Yes. I mean, assume that Seabrook was not going for license renewal but this issue was identified. You would have to decide whether or not it's enough to report it.

The reason why I think it's important is that, again, you know, I asked the question this afternoon about why only Seabrook and the answer in my judgment is that it's not only Seabrook. If the licensees look hard they may find similar situations or intermediate situations. So the issue may be larger than purely Seabrook.

MR. HOLIAN: Yes, I agree with that perspective. It has been discussed all across NRR, to the technical divisions, Division of Engineering. I do not have the answer on whether it met the threshold for Part 21. I assume it didn't from the licensee's perspective or they have the burden to report under Part 21 for an immediate safety issue.

I know that Rich Conte can speak to the CAL. It's open. So the region has opened up a confirmatory action letter on this issue and is following operability issues. They are satisfied with operability from what they've seen so far.

The further question about other plants reporting, if it doesn't meet a Part 21 or one of our NUREG reporting criteria the burden will be on us to find it during inspection or to put out a bigger, better generic correspondence that requires them to report.

At this point I don't know if we've pushed the safety significance to that issue. Clearly Seabrook is the most crucial. I think it is in one way fortuitous that it was found during the license renewal review. That's one point. The licensee has known about it for awhile, even prior to the license renewal. We would have probably liked to have seen it highlighted more in the application. That's part of that 10-month delay as we've ferreted out what may be an acceptable program. We still have questions on that.

But I will take the reporting piece with us. It is on our mind at NRR for extent of condition across the fleet.

DR. BONACA: Thank you.

MR. CONTE: We also looked at the

reportability on the primary containment condition. It didn't meet the threshold of what's in the tech spec requirements.

There's also another factor here. One of the ongoing inspection issues is the current applicability of their design basis code, the 3.18.19.71, that assumes ASR-free concrete. And a lot of the relationships, especially when you look at shear stress which are based on the compressive strength numbers, we have been constantly challenging the licensee in their operability determinations.

And I think right now the breakthrough has been when the licensee has done an independent research on the literature and independently came up with some of these parameters like shear capacity and put that in their bounding calculation. So, in fact if you were to do the calculations today you would conclude they meet the design basis code. What's the report? So this is somewhat of a unique problem. I'm pretty -- Bill Raymond, are you on the line?

MR. HOLIAN: He might be on the line. It's on mute.

MR. CONTE: I'm pretty sure we thought about the Part 21 criteria and we came to the conclusion it wasn't applicable at this point. We can still check.

DR. BONACA: Thank you.

MR. RAYMOND: Rich Conte, can you hear me?

MR. CONTE: Yes. Bill, do you have anything more to add on the Part 21 issue?

MR. RAYMOND: I agree that the Part 21 criteria appear not to have been met. The NUREG reporting criteria appear not to have been met. The calculations that have been done so far showing that you don't have a condition that would warrant -- rise to that level.

MR. HOLIAN: And just for the record that's Bill Raymond, senior resident instructor at the site.

MR. CUNANAN: Are there any further questions? The following slides will explain the staff's position related to ASR. So the staff will provide an overview of the ASR phenomenon including the effects on structures, discuss the conditions of concrete structures at Seabrook, discuss the status of tests conducted and planned by the applicant to provide input to the aging management program and discuss the staff's concerns and initial observations of the aging management program submitted on May 16th, 2012. Next slide.

As the applicant has stated in its presentation in order for ASR to occur the concrete structures must have alkali in the cement, reactive aggregates and exposures to water. Next slide.

This slide in general discusses the effects of ASR in concrete. So I would like to introduce Abdul Sheikh who will provide further details in the ASR issue. Abdul?

MR. HOLIAN: Subcommittee Chairman, point of order again just to interrupt. At this point the staff usually tries to not repeat some of the issues so we'll -- I'm just reminding the staff in the sake of the time to maybe just paint the picture of where we stand with differences. Is that appropriate?

CHAIR SKILLMAN: Yes, sir.

MR. HOLIAN: Okay, thank you.

CHAIR SKILLMAN: Thank you, Brian.

MR. SHEIKH: My name is Abdul Sheikh and

I'm going to address some of the concerns the staff has. And this slide we have captured what's the effect of ASR on concrete. And the applicant has addressed most of these issues. But I would like to find out about the degradation of mechanical properties of concrete. There we have some difference of opinion with the applicant.

The applicant has stated there is no change in the compressive strength of the concrete due to ASR but we have searched the literature also and we have found from among hundreds of appears there is a difference of opinion on this issue. And the consensus is that there is some reduction in compressive strength of concrete due to ASR. It depends on, you know, the type of structure and the confinement and whatnot. So it's not a blanket statement that the concrete compressive strength does not decrease.

Secondly, we agree with the applicant that there is the reduction in tensile and shear strength and bond strength and elastic modulus of the concrete because they have -- the degradation is more pronounced.

And also the major item which we have

been fighting for the last so many months is our opinion is that the original design was based on non-ASR concrete. In that non-ASR concrete the design codes provide an implicit relationship between the concrete compressive strength and the shear strength and the bond strength. For instance, if you have a compressive strength of 100 psi it tells you shear strength will be so much percentage of the compressive strength. Because of the cracking in the concrete the tensile strength obviously is -- because cracks is reduced appreciably more than the compressive strength. Similarly, the elastic modulus, similarly the shear strength which is a function of tensile strength.

I would like to note here that based on our RAIs for the last 18 months the applicant has finally changed their approach on this issue. And applicant has finally concluded that the compressive strength results alone are not sufficient to manage the aging of the ASR.

Now I'll go to the next slide.

CHAIR SKILLMAN: Abdul, let me ask a question and that question is this. Is there any notion that the cathodic protection system out of service for all of those years has had anything at all to do with ASR?

MR. SHEIKH: I'm not a cathodic protection expert but my immediate reaction based on what the applicant presented in the presentation that they have checked the rebars and they found no corrosion because concrete is very alkaline around the rebar. So there doesn't appear to be any effect due to cathodic protection.

CHAIR SKILLMAN: Thank you. Would the licensee like to weigh into that? Let's proceed. Excuse me, I'm sorry.

MR. HOLSTON: My name's Bill Holston. I'm Division of License Renewal. I am the subject matter expert on buried piping and cathodic protection, and I could not conceive of an impact to the cathodic protection out on the ASR aging mechanism. So I would not say that it being out of service caused this problem to be worse.

CHAIR SKILLMAN: Thank you. Please proceed.

MR. SHEIKH: Okay. So this picture we took out of a newspaper and our famous Ted Vassallo is in the picture. You know, the applicant.

MR. BARTON: Is this out of the Boston Globe or what?

MEMBER SIEBER: Boy, those three guys all look the same.

MR. SHEIKH: So as you can see and the applicant has explained so I don't need to go further there is pattern cracking under this tunnel. And as the applicant explained the reason the ASR occurred because the previous industry standards were not able to detect slow expansive aggregate or reactivity.

The new standards, the ASDM standards as the applicant said can detect the slow expansive aggregate. That's why we have issued an information notice to the other licensees to look into this issue last year.

As we understand now there are 19 structures which are affected by ASR based on the extended condition investigation performed by the applicant. Most of these structures are located below grade and they are subjected to about 30 to 40 feet of groundwater. Some of these structures are exposed to about 80 feet of groundwater.

MR. BARTON: What was that? How many

feet?

MR. SHEIKH: Eighty feet.

MR. BARTON: Eight zero?

MR. SHEIKH: Right.

MR. BARTON: Okay.

MR. SHEIKH: But now we understand today that there are some structures which are above grade and they also have ASR.

As the applicant stated the waterproofing membrane which was provided during construction on these walls is not functioning. And they don't -- Seabrook does not have a groundwater dewatering system which would prevent the ingress of water into the buildings.

So, after the applicant found this problem in the electrical tunnel they went into the containment building. And let's go to the next slide, please. And as applicant also showed this picture in a different way, that there was about 6 feet of water in this annular space which is 4 to 6 inches wide.

Applicant has dewatered the area and you know, they have observed and confirmed that the ASR is present in the right side of the picture where

I'm looking which is the containment enclosure building. So there is no difference of opinion as far as the containment enclosure building is concerned that there is ASR present.

However, we have been going at the area which is the left side of the picture which is the 48-inch thick containment building. Initially the applicant stated that ASR is not present in the containment concrete. Recently in response to an RAI the applicant informed the staff that they have observed pattern cracking in the concrete in two areas of the containment that was exposed to groundwater.

Based on the walkdown information the applicant determined that the containment concrete may be indicative of ASR. This is the exact statement from their letter. However, the applicant has not performed any further reevaluation or petrographic examination to confirm whether ASR is present in the containment or not.

In addition, I am not aware of any evaluation the applicant has performed about the structural integrity of the containment building if there is ASR present. The reason for my concern is that if ASR is present the concrete is going to be degraded and we need to know over the long term what is the effect of ASR on containment.

MEMBER SHACK: You're not comfortable with the notion of the 3D reinforcement?

MR. SHEIKH: I don't know what the extent of the problem, especially the applicant position on different issues have evolved over time. As I explained. You know, initially we were told there's no cracking. Initially we were told there's no ASR. In the recent letter they said it could be indicative of ASR and they found two cracks. So I don't know the extent of the problem.

We either need to confirm there is ASR. If there is ASR they have to go through the exercise to see what's the impact of it on the containment.

MEMBER ARMIJO: Will you require core samples and petrographic examination from the containment to be satisfied that there is or is not ASR?

MR. SHEIKH: Yes, either -- yes, that's one way of looking at it. Because -- or if like the applicant has already stated now recently that the containment concrete may be indicative of ASR. If that is the case they have to demonstrate and do further work what is the impact of this ASR on containment concrete.

CHAIR SKILLMAN: Let me ask this question and it goes back to John Barton's question some hours ago relative to why wait until 2015 to do these inspections. What is identified on page 330 of the SER is that the applicant is committing to five -- no more than five RFOs of inspections, 36 locations, 10 degree centers. The building's 100 feet in diameter. It's approximately every 8 to 10 feet around the circumference of the building.

Why isn't there some connection between this set of inspections and the operability determinations? To go down that wall around the entire periphery at various heights, to really smoke out whether or not there is a phenomenon that's occurring under everybody's nose but they just haven't seen it because they haven't looked.

MR. SHEIKH: The issue you are talking about if I understand correctly is about the liner plate which is -- if you can point to that 48-inch thick wall.

CHAIR SKILLMAN: I know where the liner plate -- it's on the left side of the 48-inch wall. I understand that.

MR. SHEIKH: Right, I'm sorry. So the liner plate is there and our concern was the 6 feet of water which has been there for awhile. We don't know exactly how many.

MEMBER ARMIJO: I think they said since construction. Maybe.

CHAIR SKILLMAN: A long time. A long time.

MEMBER ARMIJO: That's hard to understand. Since construction is a long, long time and nobody looked?

MR. SHEIKH: I cannot answer that issue.

CHAIR SKILLMAN: So my question is why isn't there some pressure being applied for a heightened sense of urgency to do some of these inspections? It's an operating plant. I understand they've done a prompt operability determination. I understand the discussion relative to if you do the calculations the concrete seems to be good to go even by today's standards. But there was an existing condition for a relatively long time that could have compromised what is really a safety component of the containment.

MR. CONTE: There was, Mr. Skillman, there was an evaluation of the -- at the time they called it a craze cracking on the primary containment. We looked at that evaluation. One point I think that was made is that this water is under atmospheric pressure. So you don't have the hydraulic pressure coming in from that outside wall. If you will, the containment enclosure building on the right there is perhaps the sacrificial lamb to this effect. So without the atmospheric pressure you wouldn't expect a lot of driving head into the concrete.

Now there is those areas, I believe, maybe the licensee can correct me if I'm wrong, but I believe they did a chemical analysis on the deposits and at least preliminarily they were saying that it wasn't ASR. And so that evaluation, there really is no operability determination on the primary containment because it doesn't look like there's that much of an effect as with the containment enclosure building and some of these other structures.

Does the licensee want to offer any new information on that?

MR. NOBLE: This is Rick Noble again. Yes, just to clarify a couple of things I guess. So we are kind of mixing a couple of things with liner plate degradation and ASR.

The UTs that we're talking about doing on the inside are to determine if there's any thickness lost to the liner plate. It really would have nothing to do with ASR, those 10 degree checks. And as Ted mentioned we have done informational UTs that haven't shown any liner loss and we have removed the water so the driving force for that.

As far as there being ASR in the containment structure itself I don't think there's a lot of controversy on it. I think what we've seen is there's pattern cracking there which is potentially ASR. We don't see the other markers for ASR. It's very small cracks. You don't see any effervescence. You don't see the other markers you'd expect to see with ASR. So if there is ASR it's at very low levels. However, since it was wetted at one time and it does show pattern cracking we are monitoring that as a potential ASR location.

So it's not being ignored, it's actively being monitored for ASR in that location.

MEMBER ARMIJO: But if the enclosure wall has ASR and this whole region was flooded with water for a significant length of time and everything was built with the same kind of concrete and the same kind of aggregate, I don't understand what's going on.

MR. NOBLE: This location is 30 feet below grade so on the enclosure side you see the driving head of all that water that's forcing it through that enclosure building. So that wall is saturated and then the water is building up in this annulus area between that building and the containment. So now there's only 6 feet of driving head going into the containment. That's the basic difference is you've got 30 feet of driving head saturating one wall and only 6 feet of static head on the other wall.

MR. HOLIAN: This is Brian Holian, Division of License Renewal. Chairman, I knew operability would come up. We're prepared to address it at one level but I did want to take it to a little bit of a higher level. One, it's the licensee's burden to call operability. It's the staff's burden to question that which we are doing. It's ongoing.

There is a confirmatory action letter in place that discusses operability. I mentioned just 2 weeks ago headquarters staff were there with the region onsite. They're going back next week I believe it is. So that is a current issue that's still open with the region. The region has taken an initial look at it and has not been able to deem it non-operable. Your question goes further to should we be enhancing the testing or getting the data quicker to enable us to do that and that's an open issue between the region and headquarters and the licensee.

I'll talk more about it. Just to mention there was just a charter issue, public charter issue between Region 1 and headquarters, kind of a technical interface team that is looking at the Seabrook issue primarily for the current operability issues.

CHAIR SKILLMAN: Thank you. And I do recognize that we began Melanie said we're not really here to discuss current operability. We're here to discuss license extension. So I understand that and I thank you but I wanted to pulse the staff to find what the answer would be. Thank you.

MR. SHEIKH: Can we have the next slide, please? So, as I talked about now I will address the Seabrook operating experience, where they are, what tests they've performed and what they plan to perform to my understanding.

Initially they reported that the compressive strength has reduced by 22 percent and the modulus of elasticity for the tunnel area was reduced by 47 percent.

I want to bring this into perspective. When the concrete -- and they compared these data to the original tests which were performed in 1989. Since 1989 the concrete has hardened and the normal increase in compressive strength and the modulus of elasticity at least all the codes agree is in the range of 20 to 25 percent. For instance, if the concrete strength was 4,000 psi measured at 1989 it would have increased. If there was no ASR the concrete would have increased to 4,800 psi which is a well-known fact. There's no denying.

So they compared the first sets of

cylinders not to 4,800 but to 4,000 psi and they found 22 percent reduction. If you compare it with the additional strength the reduction in strength would have been a lot more.

Number one. We agree that if you take a core and all the ACI standards state if you take a core the strength measured from the core is less than the original cylinders. But that is only about 10 to 15 percent. So, the applicant has stated that they did another type of test and they are attributing this change to the type of, you know, the testing done at two different labs.

But then we have to also look at what is in the literature and the literature is not in agreement. There -- it seems to be, you know, disagreement between different researchers whether the compressive strength reduced or not. So I would like to point that out. But the elastic modulus was originally reduced to 47 percent and that's what the applicant reported.

Since then the applicant has not performed any test to determine the rate of degradation of shear, tensile strength, bond strength on the concrete in the last 18 months.

They haven't, as I pointed out before, they haven't extracted any cores from the containment.

And it is a well-known fact that the visual examination cannot rule out the presence of ASR. You have to do some confirmatory tests. You can rule in and say yes, if you see pattern cracking and if you want to consider it ASR that's fine. But you cannot rule in -- rule out the presence of ASR without petrographic examination. I checked with several researchers and that's what they told me about it.

MEMBER ARMIJO: Do you have pictures of what a petrographic examination of an aggregate with ASR and without ASR is? You don't have to show it now but --

MR. SHEIKH: The applicant has those pictures.

MEMBER ARMIJO: I've seen sketches but I haven't seen actual petrographic.

MEMBER SIEBER: You've seen collapsed bridges.

MEMBER ARMIJO: No, I'm talking about down to microscopic levels.

MR. BARTON: Stuff like that you mean?

MEMBER ARMIJO: Yes. Yes, yes, yes, okay.

MR. SHEIKH: We have requested the applicant and I don't know --

MEMBER ARMIJO: There is some --

MR. VASSALLO: This is Ted Vassallo from NextEra. All the petrographic examination reports have been processed through our internal review approval system and they are all available at the site. We've also uploaded them into Certrec and they include all the data from the laboratory. It's available for your review.

CHAIR SKILLMAN: Thank you.

MEMBER ARMIJO: We can get hold of those?

MR. SHEIKH: Yes, we'll make sure.

MEMBER ARMIJO: Okay, thank you.

CHAIR SKILLMAN: Let's move along, please.

MR. SHEIKH: Yes. So, and the applicant initially planned to do small-scale tests commonly used when there's an ASR to detect the mechanical properties changes and also to determine where they are in the degradation phase, how much the ASR has progressed and how much is left. However, they have engaged the experts now from University of Texas and they are going to -- in a different approach which is they're going to do large-scale tests as the applicant have explained.

We do agree with them that this could be a useful way to do it but we haven't looked at it in more detail. We need to look more in this issue, how it will -- whether the results and the procedures are appropriate or not. The staff is still reviewing it as part of -- right.

The other thing is to find out where the -- how far the ASR has progressed. And the normal way to check that as the applicant stated is to do the accelerated test which they have performed and they found so far if I understand correctly that there is still reactivity, but they said that this is not a very conclusive test and we do agree with it. But they are doing another -- they committed to do another test which is a long-range test which is going to take about a year.

Also, in the literature which is the Federal Highway report which the applicant cited and it's produced by University of Texas. It states that you can also check the progress and the status of ASR degradation by another test which is the stiffness damage index test on the core samples. I do have the report here from the University of Texas and the applicant has stated that they did not -- they do not want to perform that test.

So, in conclusion for this slide I will say that based on the initial knowledge and RAIs from the staff the applicant approach for managing the ASR-affected structures has continued to evolve.

CHAIR SKILLMAN: Thank you. Let's move along. Next slide, please?

MR. SHEIKH: Now I will talk about the containment issue and the size of the cracks and what our concerns are about it. The applicant has observed now that there is cracks in the containment in the area where there was water. And the crack width is 8 mils. And the cracking pattern is indicative of ASR.

So, the applicant contention here is the cracks are smaller than the industry standards of 15 mils width so they are insignificant and they don't need to be addressed. Our contention, the staff contention is that the standard has been written for cracks, shrinkage cracks which are not active.

They're two types of cracks, the cracks which grow over time and cracks which was there after the initial core and they don't change in the crack width. It's a widely known fact that the ASR phenomena over time. So the cracks due to ASR we -- at least the staff consider to be active.

So if the cracks are active then the applicant has to do more work in this area. They cannot dismiss and say these cracks are insignificant because it could affect the long-term -- it could have a long-term impact on the containment integrity, especially they are going to grow.

So, in conclusion the staff is concerned that the applicant has not evaluated the effects of ASR on containment concrete for long-term degradation of mechanical properties.

CHAIR SKILLMAN: Thank you.

MR. SHEIKH: Now, I will address the aging management program which the applicant submitted on May 16th. As Arthur pointed out we have not addressed this issue in the Safety Evaluation Report. But I would like to bring to your attention the staff on March 30 committed that they will perform accelerated expansion testing, perform a full-scale replica of the test which Professor Bayrak explained. And then they will determine the crack limits and index based on this test data. And use these results to develop acceptance criteria.

Those tests are not going to be completed until 2014 so the acceptance criteria cannot be developed until 2014. However, on May 16th the applicant submitted a program and our initial observations are the program acceptance criteria is not based on full-scale or expansion test results. It's arbitrary.

In addition, the acceptance criteria is less stringent than the industry stance. The applicant showed that in, you know, provided you in their presentation a chart with tier 1, tier 2 and tier 3.

We also looked at the same publication, the Federal Highway Administration Institute of Structural Engineers. We have supplemented it with the French code. And our interpretation is what the applicant has presented is a very liberal interpretation from those documents.

For instance, the applicant says and their presentation stated that if you have a crack of 1 millimeter or 40 mil you just need to monitor it. You don't need to do any evaluation. But the ACI standard which is the original GALL document, ACI-349 tells that if you have exceeded 15 mil you have to make a structural evaluation in tier 2.

In addition, the Federal Highway Administration report which is produced by University of Austin, and I repeat here the following cracking criteria which are obtained from the crack mapping survey performed as a part of cracking index matter are proposed to identify an extent of cracking that should justify more detailed investigation. And the limit there is crack index of 0.5 millimeter and crack width of 0.15 millimeter as compared to what the applicant has interpreted from this code of 1 millimeter which is double and the crack width of 1 millimeter instead of 0.1. So we have some difference of opinion on the interpretation of the same documents.

In addition, the aging management program states categorically that the ASR will be detected by visual examination. As we have discussed -- I've discussed before you cannot rule out ASR just based on visual examination.

In addition, the applicant has stated in their presentation today on slide 27 that the accelerated expansion tests are not realistic since the results indicate reactive silica remains in the ASR-affected aggregate.

So at least there are -- we need to have more test data on the long-term tests, either the 1293 tests which the applicant is performing or the SDI tests or some other test to at least establish how far the ASR has progressed. We cannot have -- develop an aging management program based on an arbitrary criteria. We need to know what is the real structure is.

However, these are our staff's initial observations and what we wanted to point out was, one, the evolving nature of the applicant approach. On March 30 they told us something. On May 16th they came out with a different approach. However, we are still reviewing the aging management program and we will be in touch with the applicant.

CHAIR SKILLMAN: Abdul, I commend you

for your patience and thoroughness but we must move along.

MR. SHEIKH: Okay, so that's all. I have the last slide. This slide provides the staff current view regarding the ASR issue.

CHAIR SKILLMAN: Is there anything here we haven't heard before?

MR. SHEIKH: I think it's just a summary of what we have. So if you'd like I can skip it.

CHAIR SKILLMAN: Please do. Let's go on.

MR. SHEIKH: So finally the applicant has not yet demonstrated that it could adequately manage the aging of the Seabrook concrete structures due to ASR for the period of extended operation. This is our conclusion for the ASR issue.

CHAIR SKILLMAN: Thank you.

MR. CUNANAN: Thanks, Abdul.

CHAIR SKILLMAN: Arthur, go ahead.

MR. CUNANAN: In conclusion the staff does not agree with the applicant's conclusion. Until the applicant can resolve all the open items the staff cannot make a conclusion that the requirements of 10 C.F.R. 54.29(a) has been met for the license renewal of Seabrook Station. The staff also recommends a second ACRS meeting to discuss the ASR issue further. Subcommittee meeting. This concludes my presentation.

CHAIR SKILLMAN: I thank you very much. On the bridge line, are there any individuals on the bridge line that wish to have a comment? If so, please identify yourself.

(No response.)

CHAIR SKILLMAN: Hearing none, from the audience are there any members that would like to make a comment, please?

(No response.)

CHAIR SKILLMAN: Seeing and hearing none my colleagues. Dr. Bonaca, might you have any comment?

DR. BONACA: Nothing more than what I already raised before, the concern that the plant has over 20 years to go before starting license renewal. And yet this is a significant issue. And again, I think that this -- the staff is appropriately raising this issue with the industry and checking to see if this is affecting somebody else. And I agree with the conclusion that we don't have enough information to support a license renewal.

CHAIR SKILLMAN: Yes, sir. Thank you. Dr. Shack?

MEMBER SHACK: No, this is clearly a work in progress.

CHAIR SKILLMAN: Okay, thank you. Dr. Powers?

MEMBER POWERS: My tendency is to say the staff's conclusion is gently put here. My -- I come down to thinking that it's easy to overreact to this ASR and that what we really need to understand is that the containment is going to be a functional entity over the next 40 years.

And so my question is can we with the computer codes that we use for analyzing containment structures in fact take an appropriate account of ASR degradation as it is now and as it will be over the course of 40 years or not. And perhaps we need experiments such as those at -- planned at the University of Texas in order to make that judgment. But I mean, that is the question that we're really struggling with.

The other issue that comes to mind is

are we getting degradation of -- or have the potential of getting degradation of the reinforcing steel as this ASR progresses. Is there a way that we can assure ourselves that we're not degrading that reinforcing steel?

Now, the comments that the ASR can generally be detected by petrographic. While visual examinations can't rule out the existence of ASR, visual examinations can very much demonstrate that you do have ASR. But I think just the existence of ASR is not really the issue that we're worried about, it's the containment structural response that really is the issue we need to get addressed. And I just don't know whether we have the computational capability to reliably predict how ASR degrades that concrete. I simply don't know.

CHAIR SKILLMAN: Thank you. Dr. Ryan?

MEMBER RYAN: I don't have anything else specific to add but I do agree with what Mario and Bill said, what Dana said.

CHAIR SKILLMAN: Okay. Thank you, Mike. Dr. Armijo?

MEMBER ARMIJO: Yes, I agree that we need additional subcommittee meetings specifically on the ASR and the data that the staff already has and the applicant has as well as the test program that's been laid out by the applicant, the most recent test program to see if it's really satisfactory. And you know, that's all I have to add. It's just not ready.

CHAIR SKILLMAN: Thank you. John Barton, please.

MR. BARTON: My conclusion is that this is a work in progress. In fact, my conclusion in my report says that we need to continue to dialogue here because there's still a lot of unanswered questions. And the program that the applicant has undertaken is just basically still investigative. It's early. It's too early to make a decision on the future of this plant.

That having been said I have a question on the spent fuel pool leakage which we didn't talk about. And I'd like the applicant to address spent fuel pool and leakage and what they intend to do about it other than keep installing some non-metallic liner that has some kind of short half-life.

CHAIR SKILLMAN: Okay. Do you wish to

have that answered right now?

MR. BARTON: Yes.

CHAIR SKILLMAN: Someone from NextEra, can you please respond to that? To spent fuel pool leakage.

MR. ROBINSON: Yes, Dave Robinson, chemistry manager at Seabrook.

The spent fuel pool leakage, we identified it in 1999. We stopped it in 2004 with the application of a non-metallic liner. The liner was inspected periodically. We determined that we needed to replace it in 2010. The leakage has stopped after the application of each non-metallic liner. And we plan to continue to inspect the non-metallic liner and we sample the leakoff zones looking for the presence of spent fuel pool water.

MR. BARTON: So your long-term plan is to keep replacing non-metallic liners periodically.

MR. ROBINSON: Yes, sir.

MR. BARTON: Because you can't find the real leak?

MR. ROBINSON: That's correct.

MR. BARTON: You also have had concrete that's been wetted for years because of this leakage. Do you intend to do anything about inspecting that concrete? Not for ASR, but for other reasons.

MR. ROBINSON: Yes. We participated in a study on the evaluation of boric acid on concrete. Found no significant degradation in that concrete. And we plan on doing a core bore sample I believe in 2015.

MR. BARTON: 2015 seems to be the magic number with you guys. Okay.

MR. ROBINSON: So we'll validate the condition at that time.

MR. BARTON: Okay.

CHAIR SKILLMAN: Thank you. John, anything else?

MR. BARTON: No.

CHAIR SKILLMAN: Jack Sieber?

MEMBER SIEBER: I agree with everyone else. It appears that it's still a work in progress. I tend to conclude that I would favor a solution more along with essentially the rigor that the staff proposes on ASR. To find a way -- progress in that area.

CHAIR SKILLMAN: Thank you, Jack. My

own personal comment is the containment is just one of the structures. Any of the structures that is affected by ASR must be proved to be good for its extended life period. So I'm not so much fixed just on containment. Should this committee agree with a decision to go forward with life extension my view is that all of the SSCs must be shown to be good for the period of extended operation.

And with that I would like to call on Brian Holian for any comments that he may wish to make at this point.

MR. HOLIAN: Thank you, Mr. Chairman, and thank you committee. I just had a couple of comments and I'll be brief in the matter of time.

I thank the ACRS for knowing that this meeting wouldn't have all the answers from the staff. And I did want to comment on tone, just tone from the staff and tone not necessarily from the licensee but from us. It's awful hard sometimes when you see the emotion of a technical issue in the middle of that issue. And so there is some of that present here today.

The licensee has come to a public meeting in April time frame at the Headquarters One building and where we aired out some of this information. So we are trying to publicize it in those ways also to the industry. I highlighted the work by the staff and I just echo that again.

And my final comment is just to highlight the work of the DLR staff. And that's just on behalf of the committee I wanted to mention I'm moving onto another part of the Agency over in FSME dealing with materials issues. So after 4 years I just wanted to thank the committee in general for the thorough reviews of license renewal. The staff learns from them, applicants clearly learn from them also but we appreciate the independent view that ACRS has.

I have enjoyed these meetings over the last 4 years and will miss them. And I just wanted to end with that thought. Thank you.

CHAIR SKILLMAN: Thank you.

MEMBER POWERS: Finally burned you out?

(Laughter.)

MR. HOLIAN: Send me the materials.

CHAIR SKILLMAN: I would like to thank all of those who traveled to support this meeting today. I wish you safe travels on your return. I thank each of you for the even tone even though there is a difference of opinion. I believe those differences were expressed professionally, kindly, with a solid let's keep nuclear safe attitude and I appreciate that.

Are there any other comments before we end? Meeting is ended. Thank you.

(Whereupon, the above-entitled matter went off the record at 5:27 p.m.)

Seabrook Station
ACRS License Renewal Subcommittee

July 10, 2012

Personnel in Attendance

Kevin Walsh	Site Vice President
Jim Connolly	Engineering Director
Mike Collins	Design Engineering Manager
Mike Ossing	Program Engineering Manager
Mike O'Keefe	Licensing Manager
Rick Noble	Special Projects Manager
Rick Cliche	License Renewal Project Manager

Agenda

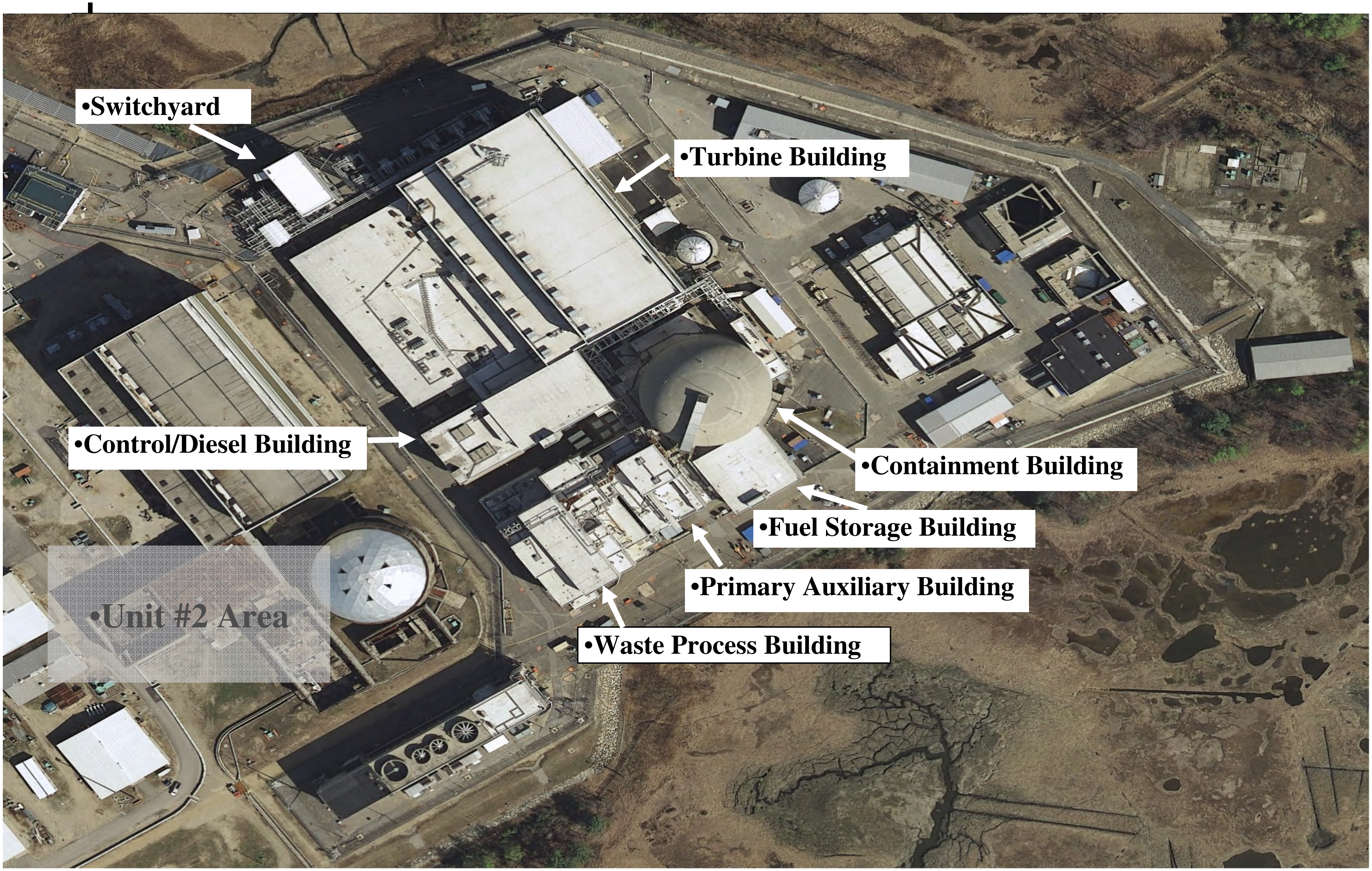
- **Background**
  - Plant
  - Status
  - Licensing
- **License Renewal Project Overview**
  - Scoping
  - Time Limited Aging Analysis
  - Application of GALL
  - Commitment Process
- **SER Open Items**

Background –

- Located in the Town of Seabrook, New Hampshire, two miles west of the Atlantic Ocean. Approximately two miles north of the Massachusetts state line and 15 miles south of the Maine state line.
- Seabrook Station is a single unit Westinghouse 4-loop pressurized water reactor with a General Electric turbine generator.
- Reactor housed in a steel lined reinforced concrete containment structure which is enclosed by a reinforced concrete containment enclosure structure.
- 3648 MWt Thermal Power; ~ 1,245 net megawatts electric
- The Atlantic Ocean is the normal ultimate heat sink.
- Approximately 1100 people on site, including contractors.

NEXTera ENERGY RESOURCES

Plant Site


•Switchyard
•Turbine Building
•Control/Diesel Building
•Containment Building
•Fuel Storage Building
•Primary Auxiliary Building
•Unit #2 Area
•Waste Process Building

Licensing

Construction Permit (CPPR-135)	July 1976
Zero Power Operating License (NPF-56)	October 1986
Low Power Operating License (NPF-67)	May 1989
Full Power Operating License (NPF-86)	March 15, 1990
Commercial Operation	August 1990
Operating License Transfer to FPL Energy (NextEra)	November 2002
Stretch Power Uprate (3587 MW)	February 2005
Measurement Uncertainty Uprate (3648MW)	May 2006
LR Application Submitted	May 25, 2010
Operating License Expires	March 15, 2030

Plant Status

- Cycle 15 – Refuel outage 14 completed in May 2011
- Current Plant Status
- Next Refuel Outage – September 2012

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License Renewal Project Overview

- Site Ownership and Oversight
- Experienced Team (Site, Corporate, Contract)
- Benchmarking
- QA Audits
- Participation/Hosted industry working groups
- Industry Peer Review

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Project Overview – Scoping

- Utilized site component database, controlled drawings, design and licensing documents
- SSCs Evaluated to Scoping Criteria 10CFR54.4 (a)(1), (a)(2) and (a)(3)
- Identified SSCs that perform or support an intended function
- Non-Safety Affecting Safety (a)(2)
  - Reviewed safety related equipment locations
  - Conservative “spaces” approach
  - Performed walk-downs for verification
- Use of commodity groups when evaluations were best performed by component type rather than SSC

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Project Overview – TLAA

- **Design and Licensing Basis reviewed for potential TLAA's**

  Keyword Search (UFSAR, NUREG-0896, Calcs, Specs)

  Review of previous LRA applications

- **Neutron Fluence**

  Determined fluence for operation to 60 years

  Materials in the extended beltline identified and evaluated

  Upper Shelf Energy values exceed the minimum acceptance limit of 50 ft-lbs

  PTS limits are below the maximum allowable screening criteria

- **Metal Fatigue**

  Cumulative Usage Factor evaluated for 60 years

  Environmentally Assisted Fatigue evaluated for NUREG/CR-6260 locations and we've committed to determine if these locations are limiting

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Project Overview – GALL Application

- **43 Aging Management Programs**
  - 29 Existing Programs
  - 14 New Programs
- **GALL Consistency**
  - 16 Consistent
  - 11 Consistent with Enhancements
  - 6 Consistent with Exceptions
  - 4 Consistent with Exceptions and Enhancements
  - 6 Plant Specific

–Buried Piping and Tank Inspection

–Nickel Alloy Nozzles and Penetrations

–PWR Vessel Internals

–Boral Surveillance Program

–SF6 Bus

–Alkali-Silica Reaction (ASR) Monitoring

Project Overview – Commitment Process

- 68 Regulatory Commitments for License Renewal
- Commitments entered into site commitment tracking system
- Implementation activities underway to ensure completion well in advance of PEO

SER Open Items

1. OI 3.0.3.2.2-1— Steam Generator Tube Integrity
2. OI 4.2.4-1— Pressure-Temperature Limit
3. OI 3.2.2.1-1— Treated Borated Water
4. OI 3.0.3.1.7-1— Bolting Integrity Program
5. OI B.1.4-2— Operating Experience
6. OI 3.0.3.1.9-1— ASME Section XI, IWE Program
7. OI 3.0.3.2.18-1— Structures Monitoring Program

Open Item – Steam Generator Tube Integrity Program

OI 3.0.3.2.2-1

- Cracking due to primary water stress corrosion cracking (PWSCC) on the primary coolant side of steam generator tube-to-tubesheet welds. *Clarify commitment*.
- Industry Experience (foreign) indicates potential degradation of steam generator divider plates. *Commitment to inspect, but not included in UFSAR supplement.*

Resolution

- LRA program has been enhanced to clarify the tube-to-tubesheet weld inspection commitment.
- LRA commitment to inspect steam generator divider plates has been added to the UFSAR supplement.

Open Item – Pressure-Temperature Limit

OI 4.2.4-1

– Consistency of methods used to develop the P-T limits with 10CFR50 Appendix G

Resolution

– RAI expected under a separate licensing action. License Amendment Request (LAR) 11-06 requested approval to extend the current curves from 20 to 23.7 EFPY.

– Consistency with 10CFR50 Appendix G will be addressed via response to LAR 11-06 RAI.

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Open Item – Treated Borated Water

OI 3.2.2.1-1

- LR-ISG-2011-01 recently issued with guidance for managing the aging effects of stainless steel structures and components exposed to treated borated water.

Resolution

- LRA updated to add affected components to the One Time Inspection Program population.

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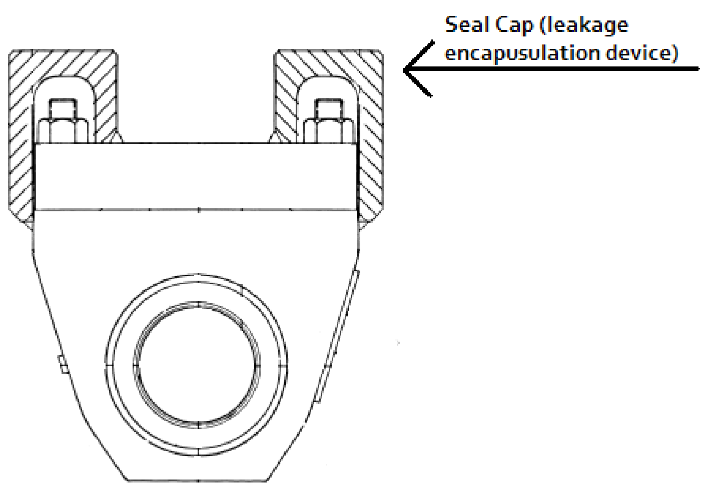
Open Item – Bolting Integrity Program

OI 3.0.3.1.7-1

– Once a seal cap enclosure is installed, the bolting and component external surfaces within the enclosure are no longer visible for direct inspection.

Resolution

– NextEra will remove the seal cap enclosure.



Open Item – Operating Experience

<u>OI B.1.4-2</u>

- – Describe the programmatic details used to continually identify, evaluate and use Operating Experience.

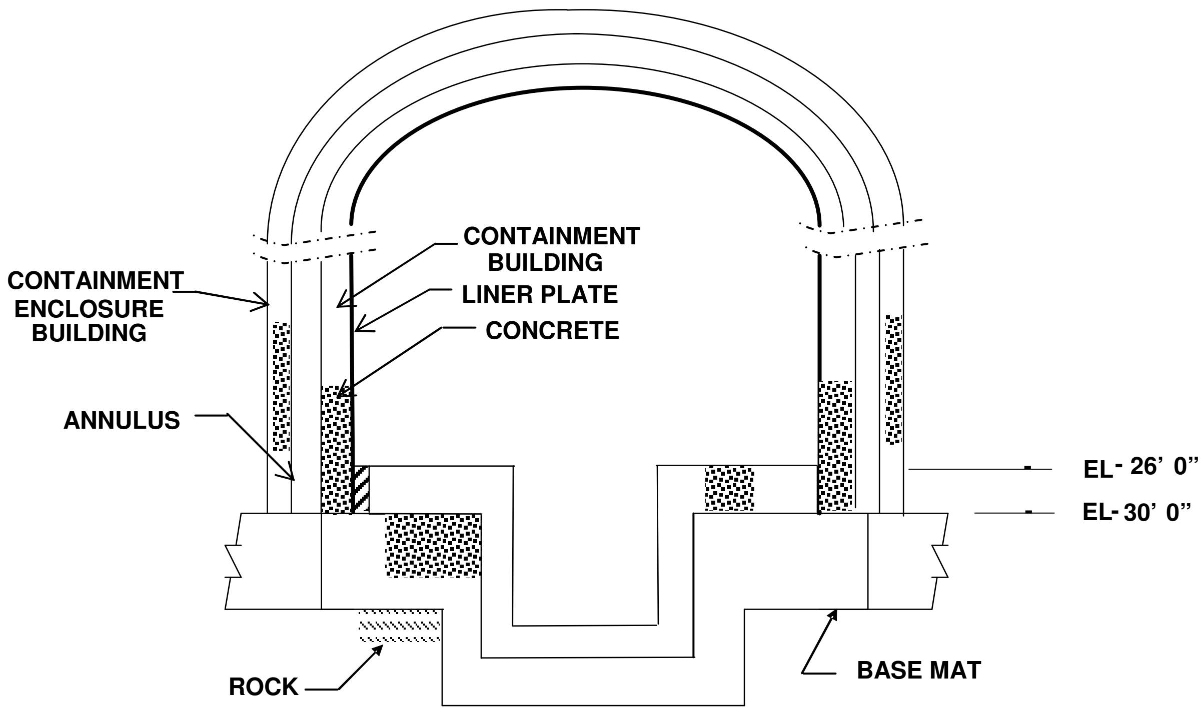
Resolution

- – LRA has been updated to document programmatic aspects of evaluating aging related OE and is being reviewed by the NRC Staff.

Open Item – ASME Code Section XI, Subsection IWE Program

OI 3.0.3.1.9-1

– Accumulation of water in the Containment Enclosure Building annular space can potentially degrade the containment liner plate.



Open Item – ASME Code Section XI, Subsection IWE Program

Resolution

– LRA updated to:

  -- Perform confirmatory UT testing of the containment liner plate in the vicinity of the moisture barrier

  -- Implement measures to maintain the exterior surface of the Containment Structure, from elevation -30 feet to +20 feet, in a dewatered state.

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Open Item – Structures Monitoring Program

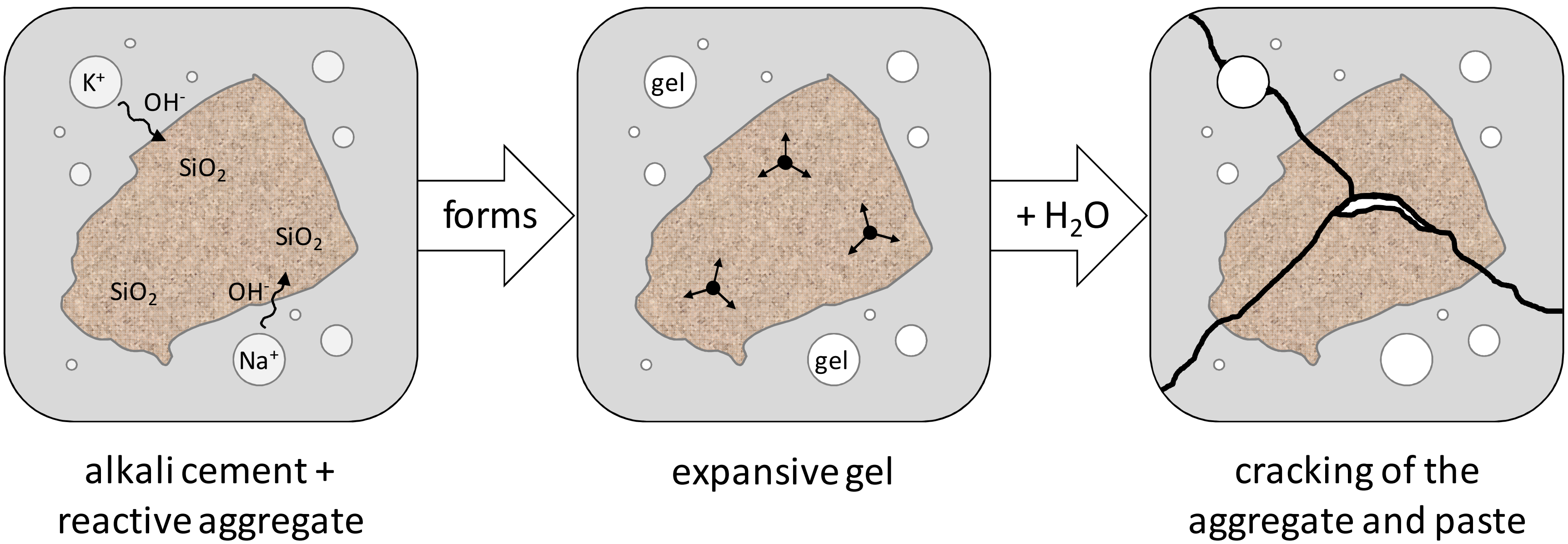
OI 3.0.3.2.18-1

- Aging management of concrete structures affected by Alkali-Silica Reaction (ASR).

- **Resolution**
  - LRA updated to augment existing Structures Monitoring Program by addition of a plant specific Alkali-Silica Reaction (ASR) Monitoring Program.
  - The program is in effect and the extent of crack expansion is being monitored.

ASR - *Background*

- ASR identified in 1930s mostly in transportation industry and dams.
- Assessments were made of 131 areas of the Plant.



ASR - *Diagnosis*

- Discovery made by petrographic examinations when concrete core samples were removed from below grade structures.
- First core samples were removed in April and May 2010.
- Testing revealed a reduction in modulus of elasticity.
- Additional concrete core samples were removed from the same and five other structures to determine extent of condition.

Insights

1. Areas affected were highly localized. Core samples taken from adjacent locations did not show signs of ASR.
2. When the length of the cores were evaluated (i.e., depth into the wall) it was observed that the cracking was most severe at the exposed surface and reduced towards the center of the wall.

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ASR - *Structural Impact*

- Confinement acts to restrain expansion of concrete similar to prestressing, thus improving performance of structural element.
- Removed cores are tested in an unrestrained condition
- No direct correlation between mechanical properties of concrete cores and in situ properties of concrete.
- Testing full scale structural elements provides more accurate concrete performance parameters.

RESTRAINED EXPANSION

UNRESTRAINED EXPANSION

NEXTera ENERGY RESOURCES

ASR - *Prognosis*

What levels of ASR expansion are expected in the future ?

- Accelerated Expansion Testing
  - -- Indicates reactive silica remains
  - -- Tested rate not applicable to Seabrook structures
    - Lack of confinement
    - Severe exposure conditions
    - Unrealistic specimen preparation (aggregate ground to sand)
- Monitoring the progression of ASR can be effectively accomplished by detailed visual inspections and trending of the observable surface of the structures.
- Crack mapping and expansion monitoring provides the best correlation to the progression of ASR in the structure.

ASR – *Mitigation Strategies*

- ASR can be effectively mitigated in fresh concrete by additions during batching.
- ASR mitigation techniques for existing structures have been shown to be ineffective.
- Stopping groundwater intrusion will not necessarily stop the progression of ASR.

ASR - *Monitoring Program*

- The Structures Monitoring Program, has been augmented by a plant specific Alkali-Silica Reaction (ASR) Monitoring Program.
  - NUREG-1800 Appendix A.1, ten element review
  - Guidelines in ACI 349.3R, “Structural Condition Assessment of Buildings”.
- Action Levels developed based on available ASR guidance.
  - “Report on the Diagnosis, Prognosis, and Mitigation of Alkali-Silica Reaction in Transportation Structures,” U.S. Dept. of Transportation, Federal Highway Administration, January 2010, Report Number FHWA-HIF-09-004.
  - “Structural Effects of Alkali-Silica Reaction: Technical Guidance on the Appraisal of Existing Structures,” Institution of Structural Engineers, July 1992.
  - ORNL/NRC/LTR-95/14, “In-Service Inspection Guidelines for Concrete Structures in Nuclear Power Plants,” December 1995.

ASR - *Monitoring Program*

- ASR detected by inspection of concrete structures by visual observation of cracking on the surface of the concrete. Baseline data collected.
- Two parameters are used to monitor the extent and rate of ASR associated cracks. One is Cracking Index (CI) and the other is Individual Crack Width. Baseline data has been gathered.
- Evaluation of a structure's condition completed according to the guidelines set forth in the Structures Monitoring Program.

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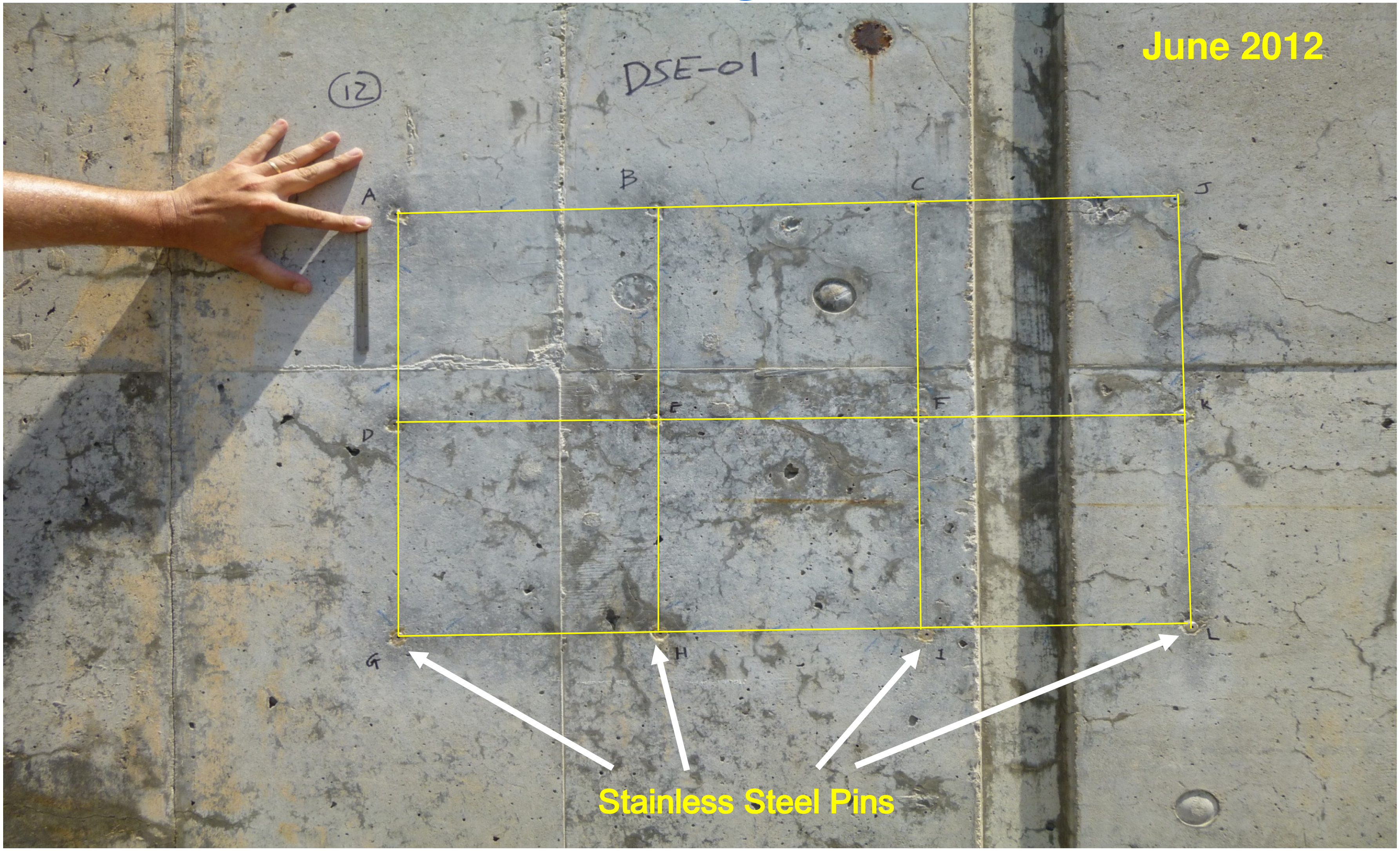
ASR - *Monitoring Program*

Structural Monitoring Program	Recommendation for Individual Concrete Components	Combined Cracking Index CCI	Individual Crack Width
Tier 3	Structural Evaluation	1.0 mm/m or greater	1.0 mm or greater
Tier 2	Quantitative Monitoring and Trending	0.5 mm/m or greater	0.2 mm or greater
	Qualitative Monitoring	Any area with indications of pattern cracking or water ingress	
Tier 1	Routine inspection as prescribed by Structures Monitoring Program	Area has no indications of pattern cracking or water ingress – No visual presence of ASR	

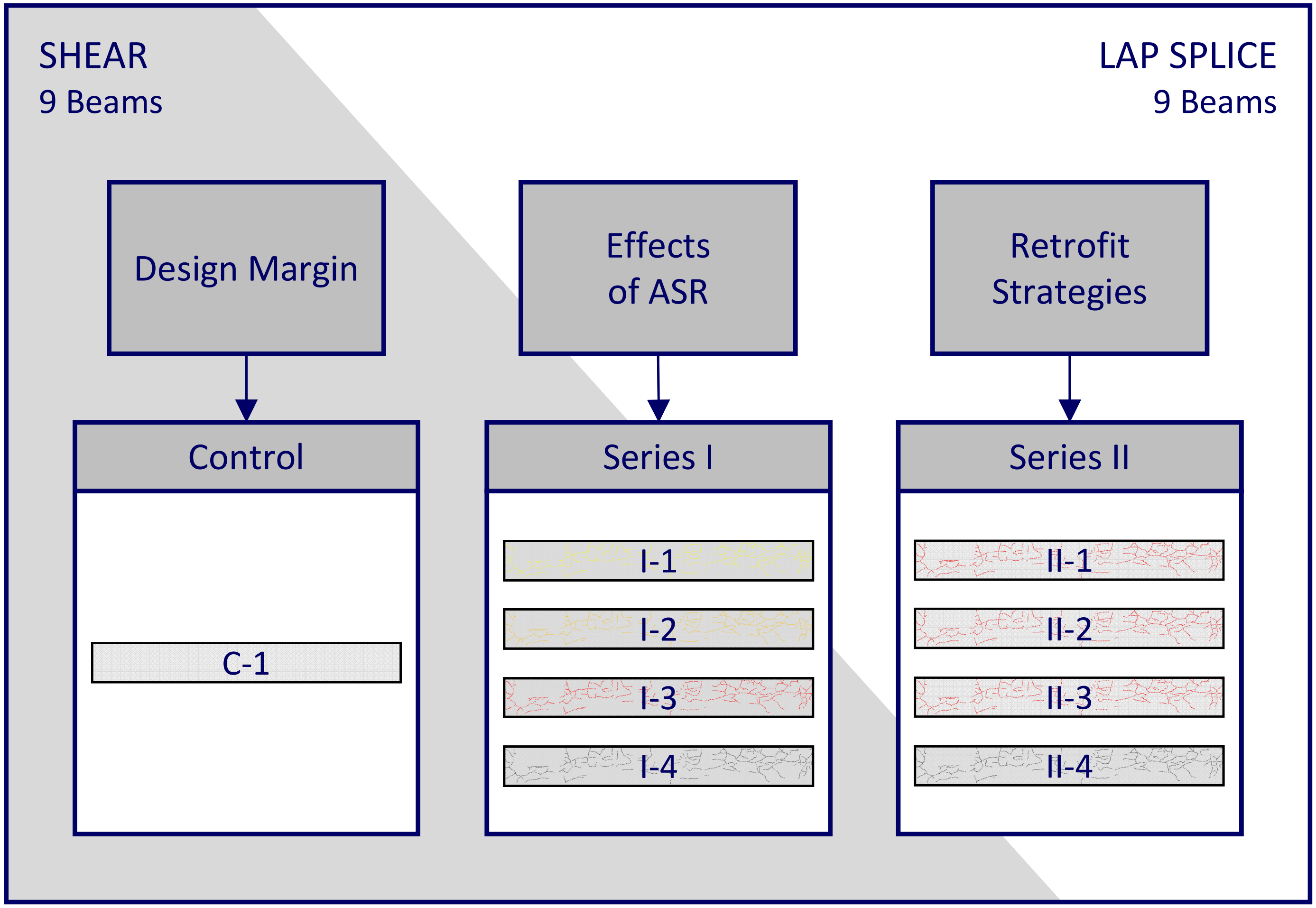
ASR - *Monitoring at Seabrook*



U-Texas- *Plant Specific Testing*

- Perform additional anchor testing using concrete blocks with design characteristics similar to Seabrook Station.
- Large scale destructive testing of reinforced concrete beams with accelerated ASR will be conducted to determine the actual structural impact of ASR.
  - Determine the actual structural impact of ASR
  - Actions levels will be established based on correlation between the test results and observed expansion levels/crack indices. *Update ASR Monitoring Program with plant specific action levels.*

TEST PROGRAMS



STRUCTURAL TESTING

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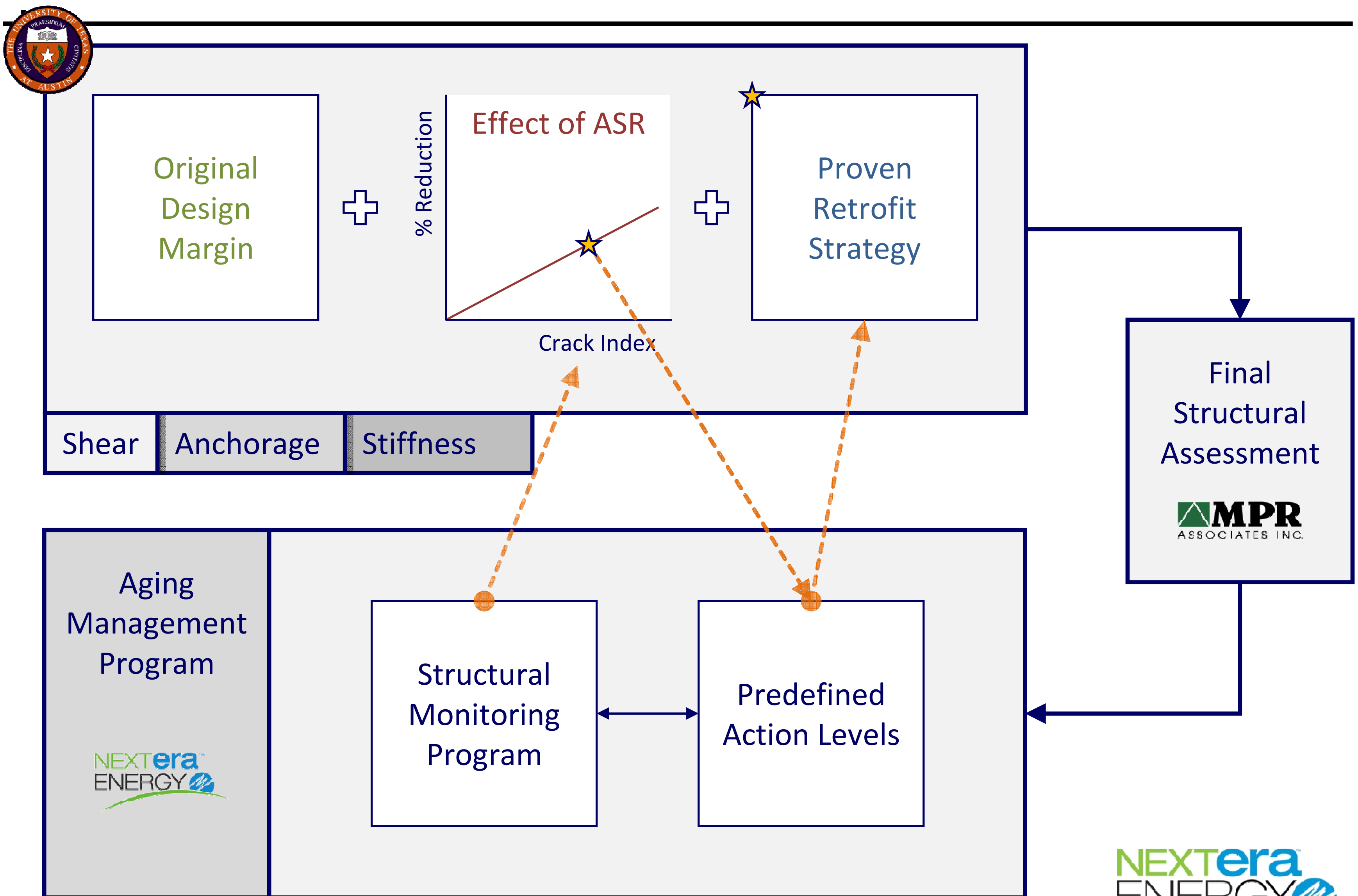
APPLICATION OF RESULTS



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ASR- *Conclusions*

- The aging effects of ASR on Seabrook Station concrete structures is understood and manageable.
- Monitoring the progression of ASR can be effectively accomplished by detailed visual inspections and trending of the observable surface of the structures.
- Crack measurement provides the best correlation to the progression of ASR in the structure.
- The Alkali-Silica Reaction (ASR) Monitoring Program provides reasonable assurance that structures will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

NEXTera ENERGY RESOURCES

Questions?

United States Nuclear Regulatory Commission

Protecting People and the Environment

Advisory Committee on Reactor Safeguards (ACRS) License Renewal Subcommittee

Seabrook Station, Unit 1 (Seabrook)

Safety Evaluation Report (SER) with Open Items

July 10, 2012

Arthur Cunanan, Project Manager

Office of Nuclear Reactor Regulation

Presentation Outline

- Overview of Seabrook license renewal review
- SER Section 2, Scoping and Screening review
- Region I License Renewal Inspection review
- SER Section 3, Aging Management Programs and Aging Management Review Results
- SER Section 4, Time-Limited Aging Analyses (TLAAs)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Overview

- License Renewal Application (LRA) submitted May 25, 2010
  - Applicant: NextEra Energy Seabrook, LLC (NextEra)
  - Facility Operating License No. NPF-86 requested renewal for a period of 20 years beyond the current license date of May 15, 2030
- Approximately 15 miles south of Portsmouth, NH
- Westinghouse 4-Loop PWR

Audits and Inspections

- Scoping and Screening Methodology Audit
  - September 20-23, 2010
- Aging Management Program (AMP) Audits
  - October 12-15, 2010
  - October 18-22, 2010
- Region I Inspection (Scoping and Screening & AMPs)
  - March 7, 2010 – April 8, 2011

Overview (SER)

- Safety Evaluation Report (SER) with Open Items issued June 8, 2012
- SER contains 7 Open Items (OI):
  - Bolting Integrity Program
  - ASME Code Section XI, Subsection IWE Program
  - Steam Generator Tube Integrity Program
  - Operating Experience
  - Treated Borated Water
  - Pressure-Temperature Limit
  - Structures Monitoring Program

SER Section 2 Summary

Structures and Components Subject to Aging Management Review

- Section 2.1, Scoping and Screening Methodology
  - Methodology is consistent with the requirements of 10 CFR 54.4 and 10 CFR 54.21
- Section 2.2, Plant-Level Scoping Results
  - Systems and structures within the scope of license renewal are appropriately identified in accordance with 10 CFR 54.4
- Sections 2.3, 2.4, 2.5 Scoping and Screening Results
  - SSCs within the scope of license renewal are appropriately identified in accordance with 10 CFR 54.4(a), and those subject to an AMR in accordance with 10 CFR 54.21(a)(1)

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

License Renewal Inspections

Michael Modes

Region I Inspection Team Leader

Regional Inspections

Overview

- Four inspectors for 3 weeks
- 10 CFR 50.4 (a)(2) inspection, non-safety affecting safety portion
- Selected Aging Management Programs for a more thorough onsite review

Regional Inspections

AMP Inspection Results

- Buried Piping and Tanks Inspection
- Lubricating Oil Analysis
- Fire Water System

Regional Inspections

Additional Inspection Issue

- ASME Section XI, Subsection IWL
- Structures Monitoring Program

Regional Inspections

Walk-downs

- Residual Heat Removal
- Turbine Building
- Primary Auxiliary Building
- East Main Steam & Feedwater Pipe Chase
- West Main Steam & Feedwater Pipe Chase
- Control Building
- Service Water Pumphouse
- Emergency Feedwater Pumphouse and Pre-Action Valve Building
- Steam Generator Blowdown Building
- Emergency Diesel Generator Room B
- RCA Tunnel
- Tank Farm Area
- System Containment Exterior

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Regional Inspections

Observation and Findings

- Applicant's review of the effects of alkali-silica reaction on structures was incomplete at the time of the inspection

- Water intrusion was noted during RHR walk-down

  - Deposits

  - Brown Stains (Membrane Failure)

Regional Inspections

Inspection Conclusions

- Scoping of non-safety SSCs and application of the AMPs to those SSCs were acceptable
- Except for the ASR issue, inspection results support a conclusion of reasonable assurance exists that aging effects will be managed and intended functions maintained
- Documentation supporting the application was auditable and retrievable

Section 3: Aging Management Review

- Section 3.0 – Aging Management Programs
- Section 3.1 – Reactor Vessel & Internals
- Section 3.2 – Engineered Safety Features
- Section 3.3 – Auxiliary Systems
- Section 3.4 – Steam and Power Conversion System
- Section 3.5 – Containments, Structures and Component Supports
- Section 3.6 – Electrical and Instrumentation and Controls System

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SER Section 3

3.0.3 – Aging Management Programs

42 Aging Management Programs (AMPs) presented by applicant and evaluated in the SER

	Consistent with GALL	Consistent with exception	Consistent with enhancement	With exception & enhancement	Plant Specific
Existing (29)	10	3	10	4	2
New (13)	6	3	1		3

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SER Section 3 Open Items

SER Section 3.0.3.1.7 – Bolting Integrity Program

<u>OI 3.0.3.1.7-1</u>

- Seal cap enclosures can contain water leakage that should be managed for aging

- LRA does not contain AMR items that address bolting and external surfaces in seal cap enclosure environments, which may be submerged due to ongoing leakage within the enclosure

SER Section 3 Open Items

SER Section 3.0.3.1.9 — ASME Code Section XI, Subsection IWE Program

<u>OI 3.0.3.1.9-1</u>

- The applicant has not implemented procedures and inspection requirements to keep this area dewatered in the future

SER Section 3 Open Items

SER Section 3.0.3.2 — Steam Generator Tube Integrity Program

<u>OI 3.0.3.2.2-1</u>

- Cracking due to primary water stress corrosion cracking (PWSCC) on the primary coolant side of steam generator tube-to-tubesheet welds

- One-time inspection of the steam generator divider plate assembly

SER Section 3 Open Items

SER Section 3.0.5 — Operating Experience

<u>OI B.1.4-2</u>

- Details of future operating experience to ensure AMPs will remain effective for managing the aging effects are not fully described

SER Section 3 Open Items

SER Section 3.2.2.1 — Treated Borated Water

OI 3.2.2.1-1

- Recently issued interim staff guidance (LR-ISG-2011-01) recommends additional aging management activities for stainless steel components in treated borated water

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SER Section 4: TLAA

- 4.1 Introduction
- 4.2 Reactor Vessel Neutron Embrittlement
- 4.3 Metal Fatigue Analysis
- 4.4 Environmental Qualification of Electrical Equipment
- 4.5 Concrete Containment Tendon Prestress Analysis (not applicable to Seabrook)
- 4.6 Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis
- 4.7 Other Plant-Specific TLAAs

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SER Section 4 Open Item

SER Section 4.2.4 — Pressure-Temperature Limit

OI 4.2.4-1

- Concerns that the methodology used to develop the P-T limits are not consistent with the requirements in 10 CFR 50, Appendix G.

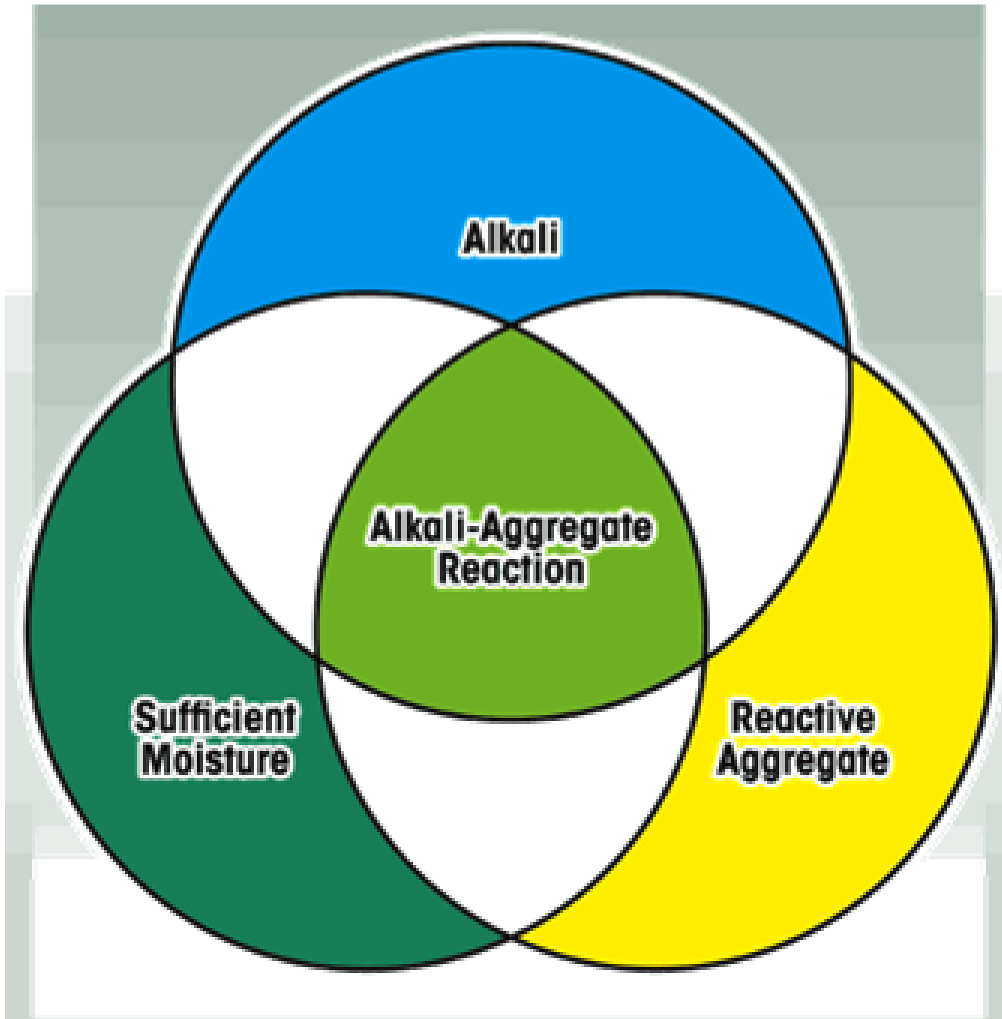
SER Section 3 Open Items

SER Section 3.0.3.2.18 — Structures Monitoring and Containment Concrete Inservice (IWL) Inspection Programs

<u>OI 3.0.3.2.18-1</u>

- The applicant's enhancement to the Structures Monitoring Aging Management Program is not sufficient to manage the effects of ASR
- The applicant has not enhanced the containment IWL program for ASR
- The applicant submitted an ASR monitoring program (May 16, 2012)

Conditions for Alkali Silica Reaction (ASR)



Effect of ASR on Concrete

- Aggregate containing silica reacts alkali hydroxides in the cement in presence of water
- An alkali silica gel is formed
- Gel swells expands and cause internal stresses
- Pattern cracking in concrete due to expansion and swelling
- Degradation of mechanical properties of concrete

ASR at Seabrook Electrical Tunnel

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Seabrook Containment and Enclosure Building

Seabrook Operating Experience: Concrete Degradation Due to ASR

- Compressive strength and elastic modulus tests performed
- Extent and rate of degradation of concrete over time—not completed
- Applicant does not plan to:
  - Perform additional tests on concrete cores
  - Extract cores from concrete containment and perform petrographic examination
- Applicant plans to perform large scale concrete beam tests
- Concrete expansion tests—in process
- Absence of ASR can only be confirmed by petrographic examination of core samples
- Applicant's approach for the aging management of ASR affected structures continues to evolve

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SER Open Item OI 3.0.3.2.18-1: Containment

Staff's Concerns

- Applicant observed cracking at two locations
  - Crack width no more than 8 mils
- Cracking pattern observed is indicative of ASR
- The applicant considers 8 mils maximum crack width insignificant
  - Cracks due to ASR grow over time
  - 15 mil crack width criteria is for passive cracks
  - GALL report and related industry standards require further evaluation of active cracks
- Absence of ASR can only be confirmed by petrographic examination of core samples
- The applicant has not addressed the long term effects of ASR on degradation of mechanical properties of concrete
- The applicant has not enhanced the containment IWL program for ASR

SER Open Item
OI 3.0.3.2.18-1: Other Structures

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Staff's Concerns

- On March 30, 2012, the applicant committed to:
  - Perform accelerated expansion testing
  - Perform testing on full-scale replicas
  - Determine crack limits and index based on test data
  - Use test results to develop acceptance criteria
- On May 16, 2012, the applicant submitted ASR Monitoring Program AMP that is under review by the NRC staff
  - Initial Observations:
    - Program acceptance criteria not based on full scale and expansion tests results
    - Acceptance criteria less stringent than industry standards
    - ASR detected by visual examination

Aging Management of ASR Affected Structures

- GALL Report recommends that the applicant augment the AMPs for the specific conditions and operating experience
- Applicant has proposed a plant specific AMP to manage ASR
- An acceptable AMP for ASR should be based on the following:
  - Baseline inspection of concrete structures to document current condition of structures
  - Extent of aggregate reaction to date and remaining reactivity/expansion going forward
  - Extent and rate of degradation of mechanical properties
  - Appropriate acceptance criteria based on test data and additional analysis

SER Open Item OI 3.0.3.2.18-1: Summary

The applicant has not yet demonstrated that it could adequately manage aging of the Seabrook concrete structures due to ASR for the period of extended operations

Conclusion

Until the applicant can resolve all the open items, the staff can not make a conclusion that the requirement of 10 CFR 54.29(a) have been met for the license renewal of Seabrook Station