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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

APRIL 8, 2014

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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 8:30 a.m., Gordon Skillman, Chairman, presiding.

COMMITTEE MEMBERS:

GORDON R. SKILLMAN, Chairman

HAROLD B. RAY, Member-at-Large

DENNIS C. BLEY, Member

CHARLES H. BROWN, JR. Member

JOY REMPE, Member

PETER RICCARDELLA, Member

JOHN W. STETKAR, Member

ACRS CONSULTANT:

WILLIAM SHACK

DESIGNATED FEDERAL OFFICIAL:

KENT HOWARD

ALSO PRESENT:

VICTORIA ANDERSON, NEI

ALAN COX, Entergy

SHERRY BERNHOFT, EPRI

AL FULVIO, Exelon

RICHARD REISTER, DOE

JASON REMER, NEI

TOM ROSSEEL, DOE

NRC STAFF:

ARACELI BILLOCH, NRR

BENNETT BRADY, NRR

WILLIAM BURTON, NRR

JERRY DOZIER, NRR/DRA

MIRELA GAVRILAS, RES

JOSEPH G. GITTER, NRR/DRA

JOHN LUBINSKI, NRR

T-A-B-L-E O-F C-O-N-T-E-N-T-S

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

(8:30 a.m.)

CHAIRMAN SKILLMAN: Good morning. This meeting will now come to order.

(Off the record comments)

CHAIRMAN SKILLMAN: The meeting has begun. Good morning, welcome. This meeting will come to order in this meeting of the Combined Plant License Renewal and Reliability in PRA Subcommittees. I will Chair the meeting. I'm Gordon Skillman, I'm Chairman of the Plant License Renewal Subcommittee.

ACRS members in attendance today are Charlie Brown, Joy Rempe, Harold Ray, Dennis Bley, and John Stetkar. Later in the meeting will come Mike Corradini, Mike Ryan, and Pete Riccardella. Our consultant, Bill Shack, is also in attendance today. Mr. Kent Howard of the ACRS staff is the designated Federal Official for this meeting.

Sixty days ago this topic was considered a future potential topic that the members of the ACRS might address sometime later in 2014 or 2015. In the past 60 days this topic has matured in importance to inviting and requiring ACRS's and other's attention today.

Affirming the importance of this topic we have with us, in addition to our ACRS Committee members and the NRC staff members, participants from NEI, EPRI, and DOE.

As we begin, therefore, I first want to recognize and thank the Leadership from the NRC staff, from NEI, EPRI, and DOE for their timely and enthusiastic preparation for and support of this topic and for this meeting.

I also want to recognize and thank our designated Federal Official, Kent Howard, for his efforts to organize and focus this meeting. The Subcommittee will review issues pertaining to SECY-14-0016, ongoing staff activities to assess regulatory considerations for a power reactor's subsequent license renewal.

In brief, the SECY address the potential for extended operation of power reactors beyond 60 years and also addresses the topic of the adequacy of the current regulatory framework for subsequent power reactor license renewal applications.

This morning we will hear presentations from the Division of License Renewal and Division of Risk

Assessment. In the afternoon we will hear presentations from the NEI, from EPRI, and from DOE, and we will then have a follow-up by the Division of License Renewal.

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, formulate proposed positions and actions as appropriate for deliberation 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.

Therefore, I request that participants in this meeting please use the microphones located throughout the meeting room when addressing the Subcommittee.

The participants are requested to please identify themselves and speak with sufficient clarity and volume so that they can be readily heard. I also request that you silence your electronic devices while you are in the meeting room. Thank you.

We will now proceed with the meeting. I welcome and call upon John Lubinski to begin the presentation.

MR. LUBINSKI: Thank you. Good morning, my name is John Lubinski, I'm the Director of the Division of License Renewal in the Office of Nuclear Reactor Regulation.

For this briefing today we will provide the ACRS with an overview of the staff's efforts in preparing for subsequent license renewal. I would like to introduce some of the staff members at the table supporting the presentation today.

Starting at the left we have Dr. Mirela Gavrilas, Dr. Bennett Brady, Butch Burton, Araceli Billoch, and Bo Pham. Our goal today is to discuss with the ACRS the process we follow in performing a comprehensive assessment of both the regulatory and technical framework to support subsequent license renewal.

We seek the Committee's confidence in our process for identifying the appropriate focus areas needed for reasonable assurance during the operations beyond 60 years.

For subsequent license renewal the staff is addressing the regulatory framework and the technical frameworking parallel. We will discuss both during the briefing today.

In our presentation you will hear several themes repeated. First is, is the regulatory framework was provided by the staff to the Commission in SECY-14-0016. The SECY requests approval to address necessary enhancements through the established rulemaking process.

This will allow full stakeholder involvement in the decision whether to proceed with rulemaking and if so what the scope of that rulemaking should be. Based on its evaluations thus far the staff continues to believe that the two principles for the first license renewal continue to be appropriate for subsequent license renewal.

These principles are, number one, with the possible exception of the detrimental effects of aging of the functionality of certain plant systems, structures, and components, the current regulatory process is adequate to ensure that the licensing basis of all currently operating plants provides and maintains an acceptable level of safety.

And the second is that each plant's licensing basis must be maintained during the renewal term in part through management of age-related degradation.

The staff continues to believe that the existing regulatory process is both acceptable and appropriate for handling safety issues beyond aging. These include emerging safety issues, enhancement to safety, and design updates.

This is based in part on the continued changes to the plant's licensing basis as they occur over the first 60 years of operation. The staff safety review for subsequent license renewal will provide reasonable assurance that actions have been taken or will be taken to manage the aging of long-lived passive components important to safety throughout the period of extended operation.

We believe the framework proposed by the staff ensures and maintains safety during the period beyond 60 years. We also believe that the changes to the two principles I discussed earlier are what's proposed to the Commission and these matters are currently under consideration by the Commission.

For the technical framework the staff is proceeding to determine, one, if subsequent license renewal is technically feasible with regard to aging management.

And, two, if it is feasible we will use the established process and that is an update of the Generic Aging Lessons Learned, GALL, and our SRP process to address these issues for subsequent license renewal.

I would like to note at this point we have not proposed any rulemaking to the Commission. What we have done in the SECY is request the Commission's approval to further engage stakeholders to address the regulatory issues identified as part of the rulemaking process.

Likewise, the staff has not completed its deliberation on the technical feasibility of subsequent license renewal at this point. We do intend to engage the Committee on the draft stage of publishing any technical basis documents.

As stated earlier, there were going to be briefings later in 2014 on these issues and we do not expect that this changes that path forward. We will be back in front of the ACRS at a future date to talk about the technical issues associated with subsequent license renewal.

If I can talk about the Agenda for the day. We've broken it up into two main parts for our presentation this morning. The first is the regulatory framework which addresses the process for subsequent license renewal and what's addressed in the SECY.

The second is the technical framework which is our effort to determine if subsequent license renewal is technically feasible. For the regulatory framework we believe it is important to discuss the regulatory processes that supported licensing for the first 40 years and how the process supported the principles of the first license renewal.

We will then discuss the first license renewal principles and processes and lessons learned from the first license renewals. We will then discuss the proposed regulatory framework for subsequent license renewal, the content of the SECY paper, and a non-concurrence that was issued regarding the paper.

For the technical framework we will discuss our process and the key issues that we've noted today. As I noted, we are still in the early process of identifying resolution of all of the technical issues.

With that I will turn things over to our first presenter this morning, Ms. Billoch, who will begin the discussion of our regulatory framework activities.

MS. BILLOCH: Thank you. Good morning, my name is Araceli Billoch and I'll be providing you with a brief overview of the license renewal program. Next slide, please.

Let me start with the initial licensing process which provides the baseline to support our decision for first license renewal and subsequent license renewal.

We split our review into two parts, safety and environmental reviews. For the safety review the NRC staff reviews obligation for initial licensing for operating reactors to determine whether the plant design meets all applicable regulations.

The goal is to ensure adequate protection for the public health and safety and the environment through the current regulatory process and incident response.

For the environmental review, in accordance with the National Environmental Policy Act, the staff proposed an environmental review to evaluate the potential environmental impacts of the proposed plant.

Next slide, please.

This slide illustrates the NRC's regulatory framework for the first 40 years of operation and the interactive and continuous nature of all the activities. The entire relationship between our regulations, licensing, and oversight activities provide for adequate protection of public health and safety at any point during the plant's operation.

The function of operating experience is important since we use this information to adjust our oversight activities and when necessary to change regulations or requirements on licensees. Next slide, please.

To ensure safety in operations the NRC relies on the current regulatory process. First, the requirements for operations are established in Title 10 of the Code of Federal Regulations.

Second, after initial license is granted the licensee may amend or modify the license depending on the activities that affect the reactor during its operations.

Third, the oversight process through inspections monitor and evaluates plant safety. Finally, operating experience allows the staff to monitor safety focus areas. The regulatory process ensures that the NRC identifies and resolves generic safety issues that affect more than one licensed facility.

When a generic issue is identified the staff issues generic communications and engages with the industry. When the licensee responds the current licensing basis of the plant may be updated. An example is Generic Issue 191, Assessment of the Reaccumulation of for Pressurized Water Reactor Sumps.

For any plant regardless of time and vintage of its design, the NRC has found through its existing regulatory process that the plant's current licensing basis is adequate for it to operate safely.

This is often mistaken for the idea that we have stuck with allowing licensees to operate plants with 1960s design and there is no need for improvements. In fact, licensees undergo numerous changes to their current licensing basis.

Some are reviewed and approved by the Agency like fire protection license amendment, some are voluntarily done through, without need for approval, like the 50.59 process, and others may be mandated through NRC orders like, for example, the Fukushima near term task force orders. Next slide, please.

So far I have discussed the overall regulatory framework for licensing. However, this slide focused on one aspect of the initial licensing process, aging management. It is often mistakenly perceived that aging management is unique to license renewal.

Aging management is important during the initial licensing process and during the first four years of operations. It is primarily accomplished through an implementation of three regulations, the maintenance rule, the QA program, and the requirements of 10 CFR 50.55(a).

The maintenance rules focus on aging management of active components. It ensures proactive oversight and changes are based on results of the inspections. 10 CFR 50.55(a) focused on the implementation of industry standards like the ASME Code for both active and passive components.

It includes specific programs for inspection and testing as well as analysis of results to inform future licensee inspections. The QA program requirements ensure licensees implement the effective corrective actions based on operating experience gained from their inspection and testing.

These concepts are important as we start to discuss license renewal. Next slide, please. I would like now to discuss the requirements for license renewal. Like initial licensing, licensing renewal includes both safety and environmental reviews.

The purpose of the safety review in the first license renewal is to provide reasonable assurance that actions have been or will taken to manage aging of long-lived passive components important to safety throughout the period of extended operation. I will provide more details on the principles of the safety review in the next slide.

For the environmental review the NRC, in accordance with NEPA, looks at generic and specific environmental impacts to conclude whether the impacts may preclude license renewal. Next slide, please.

CHAIRMAN SKILLMAN: Could I ask you please to go back to your Slide 7?

MS. BILLOCH: Yes.

CHAIRMAN SKILLMAN: Please. In this graphic you show the Maintenance Rule and you show Appendix B, Part 50, and you show 50.55(a). What you do not show are the numerous programs that the licensees undertake and that the NRC inspects relative to plant health, plant performance, trip frequency, Maintenance Rule A-1 Systems, those types of metrics that all point to the fundamental health of the facility, and in my view that information is material to whether one might consider extending the life of a plant.

Do you have a different graphic that includes all of those other elements? You kind of point to it on your Slide 5 with operating experience, but I was just wondering if you see in existing regulatory process with a thicker magnifying glass many other critical elements that give confidence that the plant in its current licensing basis is healthy.

MR. PHAM: We don't have a more detailed description. This is meant to be a summary representation and I think some of the things you mentioned are covered in the Quality Assurance Program.

I mean, for example, the requirements of the Corrective Action Program stipulates a lot of different program-added activities from the licensee. And so what we meant to demonstrate here was that, you know, the general overarching requirements that licensees have to meet in order to maintain the plant operation is through the Maintenance Rule or the various activities in the Quality Assurance Program.

So I don't think we have left anything out in specific, except we might have kind of overly summarized it in the representation.

MR. LUBINSKI: If I could also add to that, Bo, is, and I think you really did explain Slide 5. The purpose of Slide 7 is to really talk about just the aging management aspects and to try to get the point across that, as Araceli had said, aging management is not unique to license renewal or subsequent license renewal.

It occurred starting from day one and that's the point of those regulations and we were trying to highlight on Slide 7. Slide 5 is that overview that you discussed where when you look at the overall plant health, the plant safety, the regulatory process working, this is what assures that the plant operation continues, that we believe the licensing basis is adequate, that we believe that the current process is adequate.

You had mentioned some of the indicators we would use. As you see on the left hand side of the graphic you have the operating experience, then assessment to the generic issues, and that would feed back into whether or not regulatory changes are needed at that point, whether it's a change to the regulation, whether it's a change to the licensing for a specific plant, or whether it's just a change to the oversight based on those indicators.

And I believe Araceli had said when talking about this slide this is what provides us the confidence that plants continue to operate safely today and these processes continue in effect through the license renewal period and continue to maintain that confidence that the plants are operating safely.

So Item 7 was only meant to be the snapshot to talk about getting the point across that aging management does occur during the first 40 years.

CHAIRMAN SKILLMAN: John, thank you. We're back to Slide 8. John, did you have a comment at eight?

MEMBER STETKAR: Yes.

CHAIRMAN SKILLMAN: Okay, John?

MEMBER STETKAR: Personally, and I don't, let me just bring this up here if you go to eight. You mentioned briefly the environmental review and we on the ACRS don't typically become very involved in that environmental review.

Except, there's one part of that

environmental review and I still can't understand why it's part of the environmental review, but it's the --

MR. LUBINSKI: Yes.

MEMBER STETKAR: That's why I never got a law degree and I don't want one. It's the evaluation is severe accident mitigation alternative, the SAMA is. You mentioned in the SECY paper that you've approved so far 73 I think --

MS. BILLOCH: Yes, 73.

MEMBER STETKAR: -- renewed licenses. What I'd like to explore, and I don't know whether this is the appropriate time to do it or whether later, but sometime during the discussion I'd like to explore your experience in the quality of the supporting risk assessment information that's submitted and the depth of the review that's performed of that information as part of those SAMA analyses.

Because part of what we're going to be discussing today touches on the notion of perhaps the need for risk assessment going forward and I'm trying to bet a bigger picture looking backwards in terms of what your experience has been. So, Bo, I know you're the lead on that.

MR. PHAM: Yes, I don't --

MEMBER STETKAR: I don't know whether you want to discuss that now or whether there's appropriate time later?

MR. PHAM: No, I think that I'm going to recommend that we defer that until later. We have a specific section talking about PRA.

MEMBER STETKAR: Okay.

MR. PHAM: And so we'll --

MEMBER STETKAR: That's good. I just wanted -- It's pumped in my memory because it was --

MR. PHAM: Yes.

MEMBER STETKAR: Thank you.

CHAIRMAN SKILLMAN: Okay?

MS. BILLOCH: Yes.

CHAIRMAN SKILLMAN: Okay, back to Slide 9, eight or nine?

MS. BILLOCH: Yes.

MALE PARTICIPANT: Nine.

CHAIRMAN SKILLMAN: Nine, okay.

MS. BILLOCH: This slide includes the fundamental principles that make license renewal review possible. First, that with the exception of detrimental effects of aging the existing regulatory process as I discussed in the previous slides is adequate for safe plant operations.

The second and equally important principle is that each plant's current licensing basis must be maintained during the renewal term in part through management of aging degradations. These principles were established during the development of the rulemaking for Part 54 and have carried us to where we are with respect to license renewal. Next slide, please.

This slide, it's meant to illustrate the overall regulatory process for safety during the license renewal period. The left side is the same as the slide we discussed before, that current regulatory process continues to be maintained and to be effective during the license renewal period.

The additional aging management box to the right represents the additional licensing basis requirements for license renewal. As you can see in the diagram the existing regulatory process observes the aging management aspect for license renewal.

First, the requirements were established during the development of specific regulations, 10 CFR, Part 54. Second, licensing ensures the implementation of both generic and plant-specific Aging Management

Programs to ensure components continue to perform their intended safety functions.

Third, inspection programs verify licensee implementation of Aging Management Programs. Finally, operating experience reviews include knowledge gained through the implementation of Aging Management Programs.

All of these processes, lessons learned, are valuable and implemented both generically and on a plant-specific basis. Next slide, please.

CHAIRMAN SKILLMAN: Well let's go back to nine just a second, please.

MS. BILLOCH: Sure.

CHAIRMAN SKILLMAN: Yes, the way that bullet is presented it basically says the regulatory basis, or the regulatory process is adequate for everything but, potentially, detrimental effects, and on Slide 10 you show the red or the pink add-in for the detrimental effects.

Is that what you're communicating on Slide 9? You say everything but and this is the exception?

MS. BILLOCH: Yes.

CHAIRMAN SKILLMAN: And that is the add-in to your previous graphic?

MS. BILLOCH: All right, yes.

CHAIRMAN SKILLMAN: Okay, thank you.

MR. PHAM: At the time of document 50.54 initially the Commission was trying to, looking at anything that was otherwise unique, uniquely relevant to a period of extended operation and at the time the aging management, or passive long-lived components were in particular was that one piece.

And what we also try to demonstrate here in these next slides we haven't gotten to is the fact that, you know, part of the reason why that additional piece was identified was the fact that their possibility of the Maintenance Rule and the Quality Assurance Program focusing on components that were passed, you know.

The Quality Assurance Program certainly focuses on components that were more, indicators that were more readily available for active components and the concern with the Maintenance Rule at the time, it was fairly newly implemented, was the fact that long-lived components, like concrete structures, for example, could be screened out for being inherently stable or reliable.

CHAIRMAN SKILLMAN: Okay.

MEMBER REMPE: So I don't know if this is the place to bring it up but I'd like to bring it up while the staff's in front versus industry or other folks that will be presenting today.

We got a lot of background material to read for in preparation of this meeting and some of the background information conveyed that there was a lot of work that needed to be done in the aging management and materials degradation area.

Other information indicated that the staff and other organizations had looked through what needed to be addressed and you were getting the data you need. What's the staff's opinion?

Do you think that you have identified all of the issues and are these underway that will effectively answer your questions? Do you think the effort's underfunded that you need to be doing more? What's your opinion?

DR. GAVRILAS: I think we'll address that in the technical part of the presentation. We'll give you an overview of what has happened today and what is going on now including as far as we know a high-level overview of research activities both in the industry and at DOE as well as research activities in the Agency.

During that conversation, today we'll cover that at a high level because it would be a different panel that had to address this issue with you today if we were to dwell into any detail. But we'll give you that overview and we'll have a conversation then.

MEMBER REMPE: Yes, okay.

CHAIRMAN SKILLMAN: Thank you.

MS. BILLOCH: Next, yes. Like the last slide this slide demonstrates aging management requirements for the first 40 years with the inclusion of additional requirements for aging management of long-lived passive components expanded for license renewal.

This is demonstrated in the far right column and presented by the extended bar for passive components. The left side is the same as we discussed earlier. The programs established for aging management of passive components continue to be maintained and to be effective.

In license renewal some of the Aging Management Program from long-lived passive components continue to be maintained without change. Others may need to be enhanced and new aging management programs may need to be developed based on aging for long-term operations. Next slide, please.

DR. SHACK: Just if I can ask a question. One of the strengths I think of the aging management is that, you know, there's this emphasis on operational experience and that's a good thing, it says we don't have to have perfect knowledge when we approve one of these aging management programs that if something goes wrong we'll fix it.

I was reading the Inspector General's report about whether these changes are backfits, then I read the RIS and I got confused. Are you going to still maintain the same flexibility in these aging management programs?

The changes to the Aging Management Program based on operational experience are not backfits, they're really, or there's a compliance exception that the requirement is that you maintain the structure, the details of how you do that get adjusted as you go along, is that still going to be true or is there some additional considerations?

MR. PHAM: Yes, I mean, part of what you see in our Recommendation 4, of Option IV for the SECY paper was to address that and our expectation is that a licensee will continue to maintain its CLB and part of that is if new operating experience is fed back into, allow them to make changes to the Aging Management Program, that's part of the maintenance of their current licensing basis.

However, that is not explicitly stated in any particular requirements of Part 54 and I think the confusion is that, you know, how far, you know, the deciding factor or when the NRC issued the license, the renewed license, based on what the explicit requirement or expectation was to a part of what we recommended to address, to identify, or assessing the effectiveness of aging management in Option IV, this paper was to address that.

DR. SHACK: But is that their real problem? I mean my impression is that as we've gone along in license renewal certainly we've gone through several now additions of GALL and, you know, the plants have basically changed some of those Aging Management Programs reflecting operating experience and so I don't see there's actually been a real problem in doing it.

MR. PHAM: Actually part of that we'll cover in Butch's portion of the presentation. Wherever we are right now is we really don't have the data to substantiate that.

MEMBER STETKAR: But, Bo, I mean look at what has evolved in GALL --

MR. PHAM: Yes.

MEMBER STETKAR: -- over the last five, six, eight years on issues like underground piping and issues like medium and low voltage cables. All of those evolved in GALL and indeed in the current license renewal process as a result of operating experience.

MR. PHAM: Yes.

MEMBER STETKAR: It wasn't as a result of research, it was a result of operating experience. And now the license renewals that are coming in need to conform to REV 2 of the GALL Report which reflects that operating experience. So I'm not sure --

DR. SHACK: But even more importantly the old ones sort of have upped their aging management programs --

MEMBER STETKAR: That's right, yes.

DR. SHACK: -- and it really hasn't gone through a backfit process to do that and, you know, I would hate to lose that flexibility because it said if you don't that means up front you have to have perfect knowledge of what's going to happen.

MEMBER STETKAR: That's right because people will say I'm required to do this and I do not need to do anything else.

MR. LUBINSKI: And if I could add here, Bo, if you don't mind. And I think the point you're getting to is exactly the reason that we were looking at Option IV to propose this as a requirement in the Rule, because as you said when we develop this operating experience there was a couple aspects of it.

Number one is plant-specific and, you know, we've not identified any issues from a plant-specific basis where they have not incorporated operating experience into their Aging Management Programs, but the broader step is then incorporating that across the industry.

Then when we've identified or become aware of the information that we've evaluated to make a determination whether to update our GALL and then we use that when we're assessing new plants. The issue is for the plants that already have their licenses and what are they doing from a plant-specific as well as a generic basis?

We believe the enhancement further supports, as you said, Dr. Shack, that we would want to continue to rely on those programs as they move forward with the understanding, with the belief, and even more importantly with an explicit requirement that they periodically consider the operating experience and go forward in assessing their aging management programs that they used as the basis for subsequent license renewal to verify that they're still adequate.

It'll be an explicit requirement, and we haven't gotten through the words yet because, again, we're just starting the process, but the intent would be that when these new issues are identified that the licensees would evaluate their own programs.

If they're the first, second, third plant that receives a license for subsequent license renewal we want to make sure down the road, five years later when this new experience comes from maybe another plant, that those plants explicitly look at their programs, evaluate their aging management programs, and make the appropriate changes.

And, as you said, the risks that we issued discusses the points of where we're looking at under our quality assurance Programs and where the requirements are in place. But that just says if it's identified they will do so something. We want the more proactive assessment of the aging management programs as they move forward.

So it actually, I think it supports more where your concern is, that it's even enhancing that more.

CHAIRMAN SKILLMAN: Okay?

MS. BILLOCH: Yes, next slide. Now I will provide a brief of the license renewal status. First, 73 units have been re-licensed since 1998. Thirty-eight of those units will be in the period of extended operation and eligible for subsequent license renewal by the end of this year.

We have 18 additional units currently under review and the industry has indicated that nine additional units might come in for license renewal between this year and 2018. Other plants will reach the end of the period of extended operation by 2029.

The industry has also indicated that the first application for subsequent license renewal might be submitted by 2018. Also, we always had understood the role of economics that plays in any decision regarding license renewal.

Some plants had decided to shut down prior to the end of that period of extended operation. Now, Butch Burton will discuss the details for subsequent license renewal.

CHAIRMAN SKILLMAN: Before you change that slide --

MS. BILLOCH: Yes?

CHAIRMAN SKILLMAN: -- the next to the last bullet, the first SLR application expected in 2018, how many additional SLR applications do you anticipate? Are we talking about one or 20?

MR. PHAM: I think the industry is probably in a better place to answer that question, however, you know, we tried to do our best to kind of anticipate and engage with the industry on what some of the factors are and a lot of them are due to, go back to that last bullet there, is the economics situation.

I think you have factors that you do, from our perspective what we tried to look at is, you know, what the regulated market looks like out there and the other perspective is, you know, the plants that have decided to shut down early, for example, like Vermont and Yankee or Kewaunee are smaller units and sort of market on their own.

I think this concept of merchant plants having probably a harder time making the economic case would be sort of a telling indicator, you know, and we don't have a firm number, but based on our assessment of those factors we think there is a significant number of units that'll come in somewhere between the middle third of the total fleet out there, that warrants us to kind of propose going towards, on these issues on the rulemaking as opposed to just dealing with them on a plant-by-plant basis.

CHAIRMAN SKILLMAN: Okay, let me see if I can't repeat that back. I think what you said of approximately 100 current licensed plants maybe 30 might come in for an SLR and because of that number that warrants your recommendation for Option IV of the SECY?

MR. PHAM: Yes.

CHAIRMAN SKILLMAN: Is that what you're saying?

MR. PHAM: Yes.

CHAIRMAN SKILLMAN: In other words --

MR. PHAM: I think that 30 will be sort of near the low end of it.

CHAIRMAN SKILLMAN: So you're saying the economics, at least from the staff position, are great enough to warrant Option IV, that is all of the changes that you are recommending in the SECY?

MR. PHAM: Yes.

CHAIRMAN SKILLMAN: Okay, let me just pause for a minute for my colleagues. Anybody wish to stop or halt or question? Okay, Araceli, thank you.

MS. BILLOCH: You're welcome.

CHAIRMAN SKILLMAN: And, Bo, thank you. Butch?

MR. BURTON: All right. Good morning. My name is Butch Burton, I'm a Project Manager in NRR's Division of License Renewal. From our review of the current regulatory framework we were able to confirm that the fundamental principles of license renewal have served us well.

You've already heard them but I'll just again mention that the first principle is that with the possible exception of aging our current processes are adequate to ensure that the licensing bases of current plans can be maintained in depth to ensure reasonable assurance of safe operation.

Second principle, licensing basis can be maintained in the same manner and to the same extent in the period of extended operation as it was in the initial operating period. Based on this approach we've been able to put the proper focus on aging effects that are unique to license renewal.

We put special emphasis on continuous

learning throughout the license renewal program. As was mentioned we've learned many lessons from our reviews of the 73 units that have received renewed licenses over the past 14 or so years.

We're also continuing to learn lessons from the 18 applications that we're currently reviewing and we've captured many of these lessons in updates to our guidance documents, GALL and SRP primarily.

We've learned much from these interactions with stakeholders, from our interactions with stakeholders, including the ACRS. We're now learning how licensees are implementing the AMPs and using them on a day-to-day basis.

The first licensees have approximately five years of experience in their period of extended operation. There are many lessons to be learned ahead and we look forward to the knowledge that we gain and also the industry looks forward to that also.

Araceli has already provided you with an overview of the current regulatory framework and how it's been applied to the initial licensing term and to the first period of extended operation.

As you can see we followed our key principles for the license renewal program which has resulted in successful review in issuance of renewed licenses for the first license renewal period.

CHAIRMAN SKILLMAN: Butch, let me halt and ask you to back up one slide, please.

MR. BURTON: Sure, sure.

CHAIRMAN SKILLMAN: And I would like to ask about the second bullet, please, continuous learning in a license renewal. We've heard for the last few minutes about the technical issues, about GALL, about operating experience, about factoring that into decision-making for the future.

What is factored into the discussion today regarding foreign licensing renewal experience? What can you tell us about IAEA, what are the Europeans doing?

What is different about their approach to extending life versus the NRC's approach to extending life such that there may be some diamonds in their approach that we might overlooked unless we stop and talk about it? Okay.

MR. BURTON: Good question, and we do intend to talk about that. Dr. Brady in her presentation is going to go into that a little bit more. But, yes, we did look at the approaches from International perspectives and PSRs and some of those things and we did specifically take a look at that to see what insights could be gained from that, and Dr. Brady is going to actually talk about that and so --

(Simultaneous speaking,)

MR. LUBINSKI: Well before we go there -- Excuse me, if I can provide a, just give kind of the high level overview --

MR. BURTON: That's fine.

MR. LUBINSKI: -- because Dr. Brady will discuss a little more of the details, but you talked about IAEA and then you also talked about the International experience around the world and let me state from the standpoint of IAEA, IAEA doesn't have any specific requirements, any specific standards, regarding what we would call license renewal.

And the reason for that is that different countries do it different ways, whether they license a plant for 20 years, 40 years, or have no expiration date. Where IAEA does get involved are two aspects that you could relate that are called long-term operation which is where IAEA puts their focus in the words long-term operation.

One is the periodic safety reviews and they look at having a requirement that periodic safety reviews or the equivalent of a periodic safety review every ten years. As part of that periodic safety review is first a compliance review and secondly it is a safety assessment, so there's the two components to that.

We believe in the United States that our current processes that we talked about back on Slide 5 of the continued oversight and our continued identification of issues and handling them as they occur provide that equivalent in the U.S., so we are continually looking at the safety review, continually looking at compliance.

The second item that IAEA looks at is aging management. Just recently, when I say recently I don't believe they have issued a final document yet, but they had to the member States, issued an International generic aging lessons learned which puts aging management programs in place, or provides what would be adequate aging management programs.

That was heavily based on the U.S.'s GALL Report, the NRC's GALL, and we were active participants in development of those documents, so that's the two IAEA documents/requirements that are out there directly affecting long-term operation.

From the standpoint of what we've learned from International experience and how people are actually implementing it, as I said there's an inconsistency where some, you can't say that people are doing it all the same way, and what I mean by that is that, you know, some don't have expiration dates.

And then what they do is they used a PSR process to implement some of these additional requirements. So whether it's a 20 years, 30 years, 40 years, 50 years, when they're doing that periodic safety review, which they require it every ten years, they may add an additional requirement that the safety assessment look at a comparison to new designs, new design standards, new safety enhancements.

And the best we've gathered at this point is that, because we haven't seen many go into that point beyond the 40 years and how they're actually implementing it, but the terminology they're using is that they would require any reasonable and practical changes to enhance safety be implemented at that timeframe.

And that's where you see the difference right now in our presentation versus what you're looking at in PSR space and the way they're looking at it Internationally. We believe the current process we have, during the first 40 years, during the years 40 to 60, does enhance safety.

There have been changes to the licensing basis. As Araceli said it's not the same licensing basis that it was in day one because they made changes along the way for various reasons.

The International community is looking at doing that at the periodic safety reviews at the 10-year point and doing that evaluation with the intent of increasing safety. Our philosophy is the same as it was in the first license renewal. We're continuing to maintain the current level of safety.

What you'll hear from Dr. Brady later is that we did look at a select group of periodic safety reviews that were done to date. They were not done with a focus towards what I would call the equivalent of license renewal, but she will discuss some of the items that were identified in those reports and whether or not we believe those types of issues have already been handled under our current systems or how they relate to license renewal.

Does that help to answer?

CHAIRMAN SKILLMAN: Thank you, John. Yes, sir.

MEMBER RAY: Yes, well let me now --

MR. BURTON: Sure.

MEMBER RAY: I will ask you a question. It's your position is it not that the continuous learning and license renewal applies to site hazards analysis? In other words, whereas at the time of license renewal we look at a lot of things, we don't specifically update the site hazards, seismic flooding and so on, correct?

MR. LUBINSKI: We do not, and we look at that as being part of the current process. When we're talking about continuous learning in license renewal the focus there has been on the aging management and what we're learning through aging management.

MEMBER RAY: Yes, I understand that. But still in all I just want to make the point that some things get focused attention at the time of license renewal but that does not include the site hazards because it's believed that the site hazards are kept current throughout the life.

MR. LUBINSKI: That is correct. And that's --

MEMBER RAY: All right. And that's really your position?

MR. LUBINSKI: Yes, it is.

MEMBER RAY: All right.

MR. LUBINSKI: And we believe that if we were to identify that it was not kept up to date and was not kept current that that should be an action we take now, we don't wait until subsequent license renewal, we don't wait until the 60-year point to do that. Instead we would look at doing that today.

MEMBER RAY: Well, you know, I would just say that --

MR. LUBINSKI: And we have done that in response to the Fukushima event.

MEMBER RAY: Okay, you brought up Fukushima, I didn't, but the point is it is an example that's relevant to this question.

MR. LUBINSKI: Yes.

MEMBER RAY: And the argument I would make is that, just like with aging, site hazards incrementally change over time. It's very, very hard to say today the hazard is now different and we have to reevaluate it and do something about a specific plant site.

So, you know, I'm going to argue ultimately that the assumption that we keep the site hazards current throughout the life of the plant every day, every hour, is just not viable.

MR. LUBINSKI: And if I could just clarify, well let me start with, yes, I did bring up Fukushima, I took the bait on that one, yes, I brought that into the conversation and when I said up-to-date, yes, I'm going to use the work periodically.

Do plants every day look at every hazard? No. But as new information is developed, as new information evolves, yes, they do look at those external hazards and then when we become aware and believe that we need to take action generically across the board we do that and that was my reference to, in response to Fukushima.

That's an area where we've looked at and said, from a seismic issue, from a flooding issue, we want plants to go do a reassessment and that --

MEMBER RAY: Well that goes without saying, I think, but on the other hand I'm just pointing out this continuous learning issue. It just seems to me like we're not learning that things change over decades in terms of what the hazards are in ways that aren't triggering to the kind of review that you're talking about.

MR. LUBINSKI: And when Butch talks about Option IV in a few minutes we'll talk about from that standpoint why we believe it is important to keep that length to what the proposed rulemakings, or potential rulemakings are with respect, response to Fukushima, and if they're not addressed there then we would have to look at what we do for subsequent license renewals.

MEMBER RAY: Okay, but that's, you're making the point now I was hoping you would make --

MR. LUBINSKI: Yes.

MEMBER RAY: -- which is we haven't lost sight of this as an issue.

MR. LUBINSKI: Right. And we felt that was why it was important to put in the paper. We did not put in the paper to modify Part 54 for license renewal to require this review because we believe it's going to be adequately addressed in response to Fukushima.

If it is not, or it's not done in a timely manner, we will address it specifically for the first subsequent license renewal applications that come in until it is handled generically.

MEMBER RAY: And you would intend for that when this all over and done with to be explicit?

MR. LUBINSKI: Yes.

MEMBER RAY: In other words, it's not just something we talk about today and forget out a year from now?

MR. LUBINSKI: Our expectation is to be explicit in 10 CFR and probably in Part 50, not Part 54.

MEMBER STETKAR: Can I ask something, and I detest this notion of making everything focus on Fukushima as if flooding and seismic events are going to --

DR. SHACK: Well GSI 199 was in place before.

MEMBER STETKAR: That's right. So, Butch, when you get to Option IV, I was going to wait until we get to Option IV, but it's mentioned in the context of Chapter 2, the Final Safety Analysis Report, and I'd like to keep it in that context because that doesn't have the word Fukushima in it, it has external hazards.

Plants are required to update their Final Safety Analysis Report I think sort of around every two years or so.

FEMALE PARTICIPANT: Yes.

MEMBER STETKAR: And part of this continuous learning and to kind of follow on in this notion of updating the state of knowledge, for example, in Chapter 2 there are assessments of the site meteorology.

Originally when plants were licensed back, oh, I don't know, 40 years ago, people took a snapshot of oh, maybe five years worth of rain data from oh, someplace that was 100 miles away and said we're going to use that as our meteorological data.

Do the plants periodically update that meteorological data and look at trends in that meteorological data as part of their updated Final Safety Analysis Report so that maybe if they only looked at five years worth of data at a meteorological station 100 miles away because that's all they said they had, do we now have, maybe if a couple of hundred years, not a couple of hundred, let's say a hundred years worth of data because we can actually find that, from regional meteorological data and 40 years of accumulated data from the site itself?

Is that factored in as part of their process? And you can wait and answer that, if you want, in the context of Option IV or you can do it now.

MR. BURTON: Okay. Yes, actually when I

talk about Option IV I'll be talking about issues that both of you have addressed.

MEMBER STETKAR: Good, okay. Good.

MR. BURTON: But if I forget --

MEMBER STETKAR: I'll remind you, don't worry. I have it written down here.

(Laughter)

MEMBER STETKAR: If I don't write it down I'll forget, but it's written down.

MR. BURTON: Yes. And I think we --

MEMBER STETKAR: But I did want to do in the context of the updated Final Safety Analysis Report, not in the context of whatever the lawyers are going to negotiate over the words Fukushima.

MR. BURTON: Understood.

CHAIRMAN SKILLMAN: I would like just to pause here. Thank you to Harold, talking about hazards. John, about safety report each two years. Bill, reminder of, what was it, 199? Colleagues, any other comments at this stage? Joy? Charlie? Pete? Thank you.

MR. BURTON: Okay.

CHAIRMAN SKILLMAN: Go ahead.

MR. BURTON: Picking up on Slide 14. We

mentioned that we think our basic principles of license renewal have served us well, but now we're looking at licensing plants for 60 to 80 years.

What if anything needs to change for us to perform effective, safety-focused reviews on applications for the subsequent license renewal period? That was our key question.

To answer that, the staff is performing a comprehensive assessment of the current regulatory and technical frameworks to determine if they're adequate to support SLR. As John mentioned earlier our assessment is proceeding on two parallel tracks.

One to assess the regulatory framework and the other to assess the technical framework. I'll discuss the process we're using to assess the regulatory framework and Drs. Brady and Gavrilas will discuss the assessment of the technical framework.

The staff believes in the continued validity of the two principles that undergo the license renewal program, we've already mentioned them a couple of times.

The approach for SLR leverages these principles as well as the lessons learned from the first license renewal. The focus of the SECY paper is primarily on our work along the regulatory path.

The staff is continuing its assessment of the technical feasibility of SLR and we will, as mentioned before, we will engage the Committee at the draft stage of publishing our technical basis documents. Next slide, please.

In performing its review of the regulatory framework the staff identified over 60 issues it felt worthy of consideration. In disposition of these issues we set up several criteria. One was that the issue was outside the scope of license renewal and best addressed through other current regulatory processes.

For example, one of the things that we considered, should we include ISFSIs, Independent Spent Fuel Storage Installations, to be included within the scope of license renewal? We concluded that wasn't necessary, that was already covered under Part 72, but that was an example of some of the issues that we considered and we decided were outside the scope.

Another criteria was that we looked at issues and they were dispositioned because they were best addressed through guidance and you've seen that over the years with many of the ISGs that we've developed and we've incorporated into the GALL and the SRP.

We also looked at such things as internal training of some of the staff on license renewal here in Headquarters and in the regions and obviously we didn't think that that rose to the level of any kind of requirement, but there were improvements that we can make there in terms of our training.

And then finally the last criteria was we felt that the issue was best addressed through a rulemaking and those are some of the proposals that you saw in the SECY papers, such as the incorporation of 50.61(a) with regard to pressurized thermal shock as well as the incorporation of some, a requirement to ensure we had the SSCs in order to support 50.54(hh)(2), loss of large areas due to fire or explosions. Slide 16 --

MR. PHAM: Can I just kind of make a note here? I know you're probably wondering what all the various issues are. I will say that, you know, when we started out this process we did really open the door wide open to all sorts of issues that came out, things that are, you know, more or less outside of the box.

PSR was one of the items that we looked at to say is there an alternative approach to the way we license right now and I can tell you that, you know, maybe the three bullets that you have on the slides they don't really tell the full story, but, you know, we tried our best to take all of these issues that were sometimes outside of the box and very abstract compared to what we do now and put it to the test of whether the existing regulatory process works to handle that.

And that's how we came up with the disposition of the issues and, frankly, I anticipate that if we do get the approval to go ahead and engage in rulemaking a lot of this stuff will come up as part of the regulatory basis that we'll have to develop and defend as part of that process.

MEMBER BLEY: Were the 60 plus issues identified under the regulatory framework different from the issues identified for technical or was it the same list of issues and then you looked at them from both points of view?

MR. PHAM: We threw anything and everything into the mix.

MEMBER BLEY: So it's one big list --

MR. PHAM: Right.

MEMBER BLEY: -- and then you decided whether it was a regulatory problem or technical or both?

MR. PHAM: Yes.

FEMALE PARTICIPANT: Yes.

DR. SHACK: Well did you decide some of them really weren't a problem? I mean, you know, if you look at the flex equipment in the (hh)(2) would you screen them with the same rules you screen equipment now?

MR. PHAM: I think we, at the screening stage we didn't do a full blown in-depth regulatory analysis of that and so, for example, the (hh)(2) requirements, one of the things that we are proposing in Option II is to pursue that further as part of rulemaking to determine is there a framework that we can actually pull that into scope for license renewal.

And the other thing we looked at also is what about the equipment required for security? And, you know, like do the guard stations need to be age managed as well because they're relied on for safety, for security of the plant.

And I don't think we have all the answers for that at this point, but that's really, as Butch talked about, the process of how we put everything into the framework so we can further consider it.

So what we came out with is the options in the paper are the things that we thought was noteworthy and we needed to pursue further and get more, additional details on.

DR. SHACK: I see.

MR. LUBINSKI: Yes, if I could add to that, too, is, and going to the question of the over 60 issues from a technical standpoint. Yes, we believe that the issues that we felt needed further review such as the flex equipment is an example, we specifically called that out into looking at rulemaking.

Some of the other issues that we talked about such as, you know, the PSR issue, that's where I say from those issues we said we believe that we've done a thorough enough analysis that said no, we don't need to move further on there.

So the majority of those 60 issues that we've talked about are not being dispositioned through a rulemaking process or looking at them any further, you know, the security is an example there. EP, that would be one where we believe the current processes themselves and the current regulatory process is sufficient to continue to address that.

We specifically did call out those that we're going to put into the Rule, or put into consideration for the Rule, so I don't want to give the misperception that this is opening all those issues up to rulemaking, it's just those select few that we've identified.

CHAIRMAN SKILLMAN: Okay, thank you.

MR. BURTON: Okay, Slide 16. You've seen this slide before. This is an extension of Slide 10 that Araceli discussed earlier for both initial licensing for the first 40 years as well as license renewal for 60 to 80 years.

Here we've added a box to illustrate the additional activities that we believe are needed to ensure that effective management can continue for the subsequent license renewal period.

As current processes continue to be as effective as they have been, our focus will be on the effectiveness of the AMPs as they are being implemented across the operating fleet. Next slide, please. Again, you saw this slide --

MEMBER BROWN: Excuse me. If you just said I saw that in your paper, have you defined what you mean by effectiveness of the AMPs or have you laid out criteria yet for that or is that still something to come based on further thought processes on what you're trying to do?

MR. BURTON: Yes, good question. We

discussed that, what is an effective AMP, what does effectiveness mean? And what we envision is that, again, if we get approval from the Commission to move forward with this as part of the development of the regulatory basis to support a decision to move forward with rulemaking what we envision is a series of questions that we'll go out and discuss with stakeholders and that would be one of them, to start to begin to interact with those who are on the ground dealing with this to try and gain an understanding of what does effective mean.

At this point we don't have any written, firm description or definition of it, but I think that is something that in moving forward to subsequent license renewal we are going to have to get alignment all the way around with all our stakeholders on what that means.

So that is one of the things that we talked about and we anticipate having discussions about.

MEMBER BROWN: Okay, just one thought on it. I mean there's kind of two ways based on the way you all normally do things. Is your thought process that it's going to be process-oriented effectiveness determination or will it embrace or include what I would call quantitative or technical qualitative-type attributes?

I mean process is process if somebody has a process to say hey, my program is effective. The other thing is do you actually establish some types of quantitative or what I, yes, I'd call qualitative-type technical attributes that somebody should address.

I know you haven't done them yet, but so many things fall into this just process only. They've got a procedure to do it, but we haven't given them any criteria against which they should be judged.

MALE PARTICIPANT: Yes.

MR. BURTON: Sure. I think it's a great question. It's actually a little bit abstract and it's going to be a mix of both we imagine. I think what we put into the SECY paper at this point are not explicit or a specific proposed rule.

But some general areas where we talk about how to look at the assessment, or the effectiveness of the Aging Management Program. One is, is there some method to, some systematic assessment method which is a process. Another is some process to report specific operating experience, that is specifically related to aging management, another process.

But out of that process there will be, we anticipate that the information that we get from the operating experience as well as the assessment analysis will feed into the update of our guidance document like the GALL, for example.

And then the third piece is, you know, reporting, we envision some form of reporting of changes to the Aging Management Program. Bill, you had asked earlier what, does the system currently work?

It does to the extent that the staff has identified a lot of issues like buried piping, inspection of manhole covers for the electrical cabling. However, we need, what we're looking for is the plants that are implementing these programs themselves are the ones that should be informing the process.

And so the three sort of general areas where we've talked about in Option IV with respect to assessment of effectiveness of aging management, it is, you know, one, is we have to identify what that process is and then out of that process it should feed into the technical updates of the guidance document and known information from a technical or bonded perspective.

MEMBER BROWN: All right.

DR. SHACK: And on that sort of -- I notice for the buried piping, which the industry has taken fairly strong action on, they actually have a program that sort of is pretty mandated about reporting operating experience to the EPIX database.

Do you have access to that kind of information? Is that --

MR. BURTON: EPIX, yes, we do.

DR. SHACK: Okay, so you have access to that, but you don't think that is adequate to reflect operating experience and you need additional specific requirements?

MR. PHAM: I think, William, you might want to chime in on this, but I think our access of EPIX and our use of the information at this point is not specifically fed into the license renewal process.

DR. SHACK: Okay.

MR. PHAM: So there is aspect of refining that process.

DR. SHACK: But that may be your problem --

MR. LUBINSKI: But if I could also add, maybe, as stated there's a pretty strong voluntary requirement, sounds like an oxymoron, but using the industry language it's a voluntary industry program that each plant states as a requirement for themselves, but it's not an NRC requirement and there may be strong --

DR. SHACK: Well it's also not clear that it applies to anything except buried piping.

MR. LUBINSKI: That was going to be my next point. From that standpoint is it's not across the board with respect to all of the Aging Management Programs that are being incorporated from license renewal and we've engaged with the industry several times and continue in this dialogue of what they're doing with that program, are they continuing to get more information on aging management into that program or not.

So there's not that strong tie, that strong necklace to say that all of the learnings that are developed with respect to the Aging Management Programs and the effectiveness of those are being reviewed in a comprehensive manner across the industry.

And then secondly, as I said, it is voluntary from that reporting standpoint. So we would, even if we were to rely on EPIX to look at the data we may not be getting all of the data we need.

MR. BURTON: And I just wanted to chime in on one aspect of what you were saying was that in these discussions as we try to weigh process versus technical and things like that we do not want to be overly prescriptive, again, to speak to some of the issues you were talking about before.

And so that's an important balance that we're going to have to try to find as we go into the development of the regulatory basis, but that's one of the goals. What we hope to come out of that is to hopefully find that right balance as the result of the dialogue we have with the industry. So, okay.

CHAIRMAN SKILLMAN: Let's move ahead.

MR. BURTON: It's Slide 17, oh --

CHAIRMAN SKILLMAN: Eighteen.

MR. BURTON: Eighteen, sorry.

CHAIRMAN SKILLMAN: That's all right, okay.

MR. BURTON: Okay. The SECY paper proposes recommendations to explore various topics that the staff believes would enhance the efficiency, effectiveness, transparency, and regulatory stability of staff and licensee activities in preparing and reviewing SLR applications, also in implementing aging management activities and in providing inspection and oversight of the aging management activities in the SLR period.

We believe our suggestions for rulemaking directly contribute to three of the NRCs principles of good regulation, those highlighted specifically, openness, efficiency, and clarity. The goal is to reach a decision whether to move forward with a rule revision and develop a sound, regulatory basis for doing so. Next slide, please.

The SECY paper contains four options for the Commission to consider. Each successive option includes the implementation of the previous options. Option I offers no changes to the current Rule. Option II describes minor changes to update the Rule to conform with other regulations and to clarify existing regulations.

Option III expands the scope of license renewal to include SSCs for new regulations and to clarify staff expectations for complying with existing regulations.

And finally, Option IV explores rulemaking for SLR to address the areas that could substantially improve the effectiveness and the efficiency in preparing and reviewing subsequent license renewal applications and provide information for the NRC to more effectively oversee aging management activities in the SLR period.

And it also discusses the staff's approach for addressing Part 50 activities related to potential changes to the CLB by coordinating with the ongoing Fukushima activities, which we touched on a little bit earlier and we'll go more into.

At this point I'll give a brief overview of each of the staff's suggested changes to the regulatory framework for subsequent license renewal followed by a discussion of the non-concurrence that accompanied the SECY paper.

MEMBER STETKAR: Butch, before you do that, because you're going to skip to Option II. In the discussion in the SECY paper under the disadvantages of Option I there's a statement that got my attention.

It said "If the current license renewal rules are not changed certain issues would have to be addressed on a case-by-case basis when they're identified during the subsequent license renewal review."

Are those certain issues the, explicitly the ones that are addressed in the other three options, Options II, III, and IV, or are there other things that you were thinking about?

MR. BURTON: Well when we put that together we were thinking specifically about some of the items in the other options.

MEMBER STETKAR: Okay.

MR. BURTON: What we anticipate is that --

MEMBER STETKAR: So what I'm trying to understand is if I read the other three options and think about the issues that are raised in those other three options, those embody the universe of the certain issues that would have to be addressed on a case-by-case basis which is part of the disadvantages of Option I, is that correct or is there something else hovering out there in another world that hasn't been explicitly addressed in the SECY paper?

MR. PHAM: Yes, I think -- We agree with your statement.

MEMBER STETKAR: Okay.

MR. PHAM: Just to give some flavor to what we're talking about, a potential issue, you know, we're talking about the (hh)(2) requirement --

MEMBER STETKAR: As long as you say every, those certain issues that are a disadvantage is every are --

MALE PARTICIPANT: In II, III, and IV.

MEMBER STETKAR: -- in total addressed by II, III, and IV. I'm okay, I understand.

MR. PHAM: Okay.

MEMBER STETKAR: Thank you.

CHAIRMAN SKILLMAN: So they are?

MR. PHAM: Say it again?

CHAIRMAN SKILLMAN: John's question is the option out, the disadvantage of I --

MR. PHAM: Yes.

CHAIRMAN SKILLMAN: Have all been included in II, III, and IV, that's the way that's written?

MR. LUBINSKI: The answer is yes.

MEMBER STETKAR: The answer, okay, thanks.

CHAIRMAN SKILLMAN: Thank you.

MEMBER STETKAR: I just wanted to make sure there wasn't something else that I wasn't quite understanding within the scope of the paper.

MR. BURTON: And just to be clear, you know, again, what we anticipated was that otherwise we would have to develop RAIs, questions to give to each applicant --

MALE PARTICIPANT: Right. Yes.

MR. BURTON: -- and all of the inefficiencies that may come with that. So that's what we were thinking.

MEMBER STETKAR: Thank you, Butch.

MR. BURTON: Okay. So, yes, so at this point I'll give a brief overview of each of the staff's suggested changes to the regulatory framework and then talk about the non-concurrence. Yes, next slide, thank you.

First, under Option II, 10 CFR 50.61(a) provides alternative requirements to ensure protection against pressurized thermal shock, which is currently under 50.61 and is identified as being within the scope of license renewal.

The recommendation in the SECY paper suggests that 50.61(a) be included as a regulated activity for license renewal. As such, the SSCs needed to ensure compliance with this regulation would be included in the scope of license renewal and aging of passive, long-lived structures and components would be managed.

We believe it's inconsistent for one applicant to adhere to 50.61 and be required to bring the relevant SSCs within scope and manage while another applicant who chooses the 50.61(a) alternative to meet the same PTS requirement not be required to scope in and age manage the relevant SSCs.

Again, the details of what should be included in those requirements would be discussed as part of our outreach and development of the regulatory basis to support a proposed rule.

MEMBER BROWN: I guess I don't understand. If the rules are already out there don't they already apply to licensees?

MR. BURTON: Well --

MEMBER BROWN: You make this rather fine delineation between 50.61, which I'm not sure exactly what that is other than it must have to do with fracture toughness of some kind --

DR. SHACK: Pressurized thermal shock.

MEMBER BROWN: PTS?

DR. SHACK: Yes.

MEMBER BROWN: Okay. And 50.61(a) --

DR. SHACK: To some people there is nothing else in the world except PTS, to other people there's nothing else in the world than digital INC --

(Laughter)

DR. SHACK: -- or the independence of digital, sorry.

MEMBER BROWN: Okay, let's get down to the nitty-gritty here. It would seem to me if the rules are out there I mean why don't, don't they have to comply with these anyway? Why do you have to make them part of license renewal, of some other rule or modify some other rule if they're already in place? I mean I --

DR. SHACK: Yes.

MEMBER BROWN: We've been talking about PTS. I've been on the Committee now for six years and it seems, you know, you get deluged with PTS meetings just to explain all the new nuances that are going on with that, where it's like sucking blood out of rocks trying to get anybody to pay attention to INC.

(Laughter)

MEMBER BROWN: I just said that with a wink. We had to have a little humor here moving along.

MALE PARTICIPANT: Charlie? Charlie?

MEMBER BROWN: I just don't understand why that doesn't come under the licensee, they don't all have to comply with this. Why do you have to bury it now, reference it in the existing 50.54 whatever (a)(3).

MR. PHAM: Because it's not explicit right now. Basically, and this is why it's under Option II, we've considered them a fairly straightforward rulemaking, is that the current Rule references, the current Rule in Part 54 references how a licensee has to address, it's the scope and equipment that's related to meeting the requirements of 50.61.

But 50.61(a) provides that a voluntary approach, or an alternative approach, to 51 and without that specific reference to it in the Rule, and like I said it's a very straightforward proposal and we're saying one could always make the legal argument that the Rule in Part 54 requires compliance with 50.61, not 50.51(a), so that's a worst case scenario.

MEMBER BROWN: Okay.

MR. BURTON: And it is true that, you know, and we do specifically call out those regulated events in that portion of the Rule. Not just PTS, but also a station blackout, anticipated transit without scram, a number of things, fire protection, EQ.

This would just add to the clarity just as those other ones were. So that's really what was behind that.

MEMBER STETKAR: I'd like to raise something and, unfortunately, I'm going to have to duck out in about five minutes and going to miss most of the meet so I'd like to get this on the table and you just gave me a good entree to it.

MR. BURTON: Okay.

MEMBER STETKAR: In both Options II and III we just discussed PTS and the nuances of that. In Option III you mentioned well we better get the 50.55 whatever it is (hh), 50.54(hh)(2) --

MALE PARTICIPANT: (b)(5)(b) stuff.

MEMBER STETKAR: Oh, and we better make sure that we leave ourselves some flexibility to get in to the Rule something that might be identified as part of Fukushima that we don't know about yet.

And we had that long laundry list of ATWS stuff and SBO stuff and other stuff that are all very specific and very important, we better put it in the Rule.

It strikes me that what we're really trying to say is that aging management should address SSCs that are important to safety and by, you know, you're proposing changes to rules to put in well, we need to look at this specific thing over here for everybody and we need to look at this specific thing over here because we didn't think about it before.

And now we need to look at this specific thing because we wrote another rule that didn't necessarily capture something to the specificity that you think you need in this rule. Why don't we just say everything that's important to safety is in the scope of license renewal?

Now the question is what's important to safety, but it's not this piecemeal, pick and choose. For some plants ATWS may not be important to safety.

MR. BURTON: That's true.

MEMBER STETKAR: Okay.

MR. BURTON: Okay.

MEMBER STETKAR: So why is it in the Rule in a regulation for everybody and why do we have to write our rules with so much specificity in the rule that when it comes time to look at the rule again we need to revise the rule because we need to add yet another sub-bullet of specificity to it?

MR. LUBINSKI: Yes, let me, if I --

MEMBER STETKAR: Why can't we do this in guidance is what I'm saying?

MR. LUBINSKI: Yes, I'd like to comment --

MEMBER STETKAR: Yes.

MR. LUBINSKI: -- and what I'd say is that, you know, that's something we need to think about in moving forward because when we looked at it we were trying to follow it with the established process already and that's the way the first license renewal was set up.

But you bring a good point is now we're re-looking at this and should we be a little more, I don't want to use the word generic, but a little more broad in that statement of those items that are important to safety that --

MEMBER STETKAR: In the rulemaking --

MR. LUBINSKI: Right, in the rulemaking process, yes, that's what I'm saying. Because again we haven't put the final words to paper yet and I think this is a good point for us to keep in mind as we do that.

As we go to the subsequent license renewal maybe we could change that process, that philosophy from our scoping, because this all has to do with the scoping, what scopes into for aging management.

MEMBER STETKAR: That's exactly right.

MR. LUBINSKI: And maybe that would make it much clearer because the process before was always established that you did this, you put it in place, and then when you did those other rulemakings you made a conforming amendment to Part 51 to include that.

And we're looking at these areas and saying that's where we may have missed something in the process, we didn't do that conforming amendment. So what I'd like to do is take that as a comment as we're developing our rule language and our statements of consideration if we're given approval to go forward in addressing, I'd say Option II and part of Option III-type requirements to, can we do that more broadly so that it facilitates a more efficient use of resources of rulemaking in the future.

MEMBER STETKAR: Yes, not only for this update, but --

MR. LUBINSKI: For future --

MEMBER STETKAR: If there is an update now, but even going forward into the future.

MR. LUBINSKI: We do know there'll be other changes to Part 50 in the future. We don't know what they're going to be but they will be, and rather than question scoping them in at that time make this broad enough that it captures that, we'll consider that.

CHAIRMAN SKILLMAN: Let me make a comment before John scoots. The thing that I've been waiting to hear is what is it that is critical at a plant that is presently in its PEO for 20 additional years that on the 59th year, 11th month, 31st day, 2359, the bell goes bing and the component or device is not good for the first day of the next 20 years which is the second PEO?

It seems to me that that is the question that John's asking. It's about the devices, it's about the SSCs, and at some greater level the process that gets us there, but this seems to be focused on the licensing engines that are going to get spun up in order to get us into the second PEO when in reality the trigger for this should be what are the structure system's components that are critical for safety for that second PEO that begins on the first day of the 60th year?

And to me that's a much keener edge for our consideration. Right now this is a very broad, almost such a multi-faceted question that it's hard to pick out the beans from the peas.

MR. LUBINSKI: Right.

CHAIRMAN SKILLMAN: But it might be more clearly stated if in the technical considerations we identify what are the real issues on the first day of the 60th year.

MR. LUBINSKI: I think you bring up a good point and I'd say maybe that's part of our, where we could better communicate in the paper and definitely need to, if we go forward with the rulemaking, to ask to clarify that because if you look at a lot of what's in Option II and III would we do these if we were not doing the additional issues that are in Option IV and the answer is no.

Because from an efficiency standpoint it would not make sense and we would continue to do that through our current processes and current guidance capturing the 50.61 on a case-specific basis, capturing the (b)(5)(b) on a case-specific basis, so an answer to that question of we're doing that today, we would continue to do that during the current license renewal and the subsequent license renewal.

This would provide since we, if we go to the rulemaking for Option IV, a basis to just codify it in the rule and make it more clear and I like John's comment about a way to do that from the standpoint of what's important to safety.

A couple of the other issues you can't do because they are changes in scoping and we believe they are important for going beyond 60. And as you said, you know, if you look at 60 and then 60 plus a day what's the difference?

And this gets to Dr. Shack's comment about, number one is the, looking at the effectiveness of aging management programs. We believe, because it's about aging and there's going to be more concern with aging when you get beyond 60 versus beyond 40, we think that we need to make sure that we have a robust requirement in place for licensees to look at the effectiveness of aging management programs.

Another option is, that you're going to hear about in a few minutes and why is it important to 60 is the data. Right now plants can come in 20 years before their expiration date to request a license.

We're putting out do we really want people coming in that early or do we want them to gather more data so that we have more information on their Aging Management Programs that are important beyond 60.

Those two requirements we're looking at as being requirements that would open up the rulemaking. They would change the scope, so therefore we need to go to rulemaking for those. Are they magic at the age, at 60?

No, but at some point in time as you continue to move forward they become more important and it happens to be that we're looking at renewal of the license at 60 years at that point so we believe it's important to address those at that time.

So I hope that helps to answer the question. Some of these you could argue that would they apply to the current fleet, or current license renewal, and the answer is yes.

The other one we'll talk about in a few minutes is timely renewal and that's something that we're looking at as whether that would apply in this rulemaking to the current license renewal period as well to assure, again, their safe operation beyond 40 not just beyond 60.

MR. PHAM: Yes. And, Chairman, I think you brought up the basic question, what is that uniquely relevant issue starting from day one of 60-year? And I think the hardest thing is trying, you know, that was probably one of the first questions that we asked ourselves embarking on this.

What John mentioned is basically, and what we try to embody in Option IV may not look and feel like that tangible, specific piece, but I think what we are concerned, the staff's concerned about is what do we lack data in?

And that's what I think Option IV really is trying to drive us towards a place where we can get the information that we need to be assured that we can get going beyond 60 years, but that particular component or specific issue for day one of 60 years we don't have that concrete evidence right now.

CHAIRMAN SKILLMAN: Okay, let's move on.

MR. BURTON: Okay. Okay, next slide. Section 54.37 provides requirements on retaining records and information needed to document compliance with Part 54, including how long this information must remain on file.

Subpart (b) of 54.37 states that any SSCs installed before the renewed license was issued but should've been included within the scope of license renewal and made subject to aging management review or a time limited aging analysis but were not must be included in the next update of the FSAR and describe how the effects of aging will be managed during the period of extended operation.

Several applicants were confused about this requirement thinking that this might constitute a backfit and requested clarification. In response the staff issued Regulator Issue Summary, or RIS 2007-16, and a revision to it, to clarify the requirements.

However, we continue to get feedback that further clarification was needed. The suggested rule change will provide this additional clarify and clarifies the population of SSCs that we're talking about.

First of all we are talking about SSCs that are already installed at the plant, that were already installed before the renewed license was issued, should've been included within scope and subject to aging management review, but were not, and this may have been due to a couple of things, an initial oversight in the initial scoping and screening or a change in the licensing basis later on that would bring those SSCs within scope.

We acknowledge that the suggested revisions by themselves are probably not worth the resources to do a revision to the rule as we mentioned before, and we stated as such in the paper, so that's this particular suggested revision. Next slide, please.

DR. SHACK: Well why do you have Options II and III then?

MR. BURTON: Yes.

DR. SHACK: You say they're worthless.

MR. BURTON: Well -- Okay, go ahead.

MR. PHAM: Just to give you the process of how we came up with this paper is that we had a lot of issues just in one bucket initially and then we looked at the pros and cons of each of the issues basically.

We put them as options to the Commission to provide them with options as far as a resource commitment perspective, but at the same time when we issued the paper we recommended to get approval for Option IV meaning it'll encompass, implement, going forward with Options II and III as well.

But it's a way to get the, to provide to the Commission, you know, just a flavor of the level of disparity or differences between the different gradation of options out there.

MR. LUBINSKI: And I think your question is really not between, I think your question was between Options II and III, why wasn't II and III just combined together and I think what we were trying to, to get the point across is we felt that the options in Option II were much more minor.

Whereas Option III with some of the scoping of the equipment as well as the timely renewal issue was more significant, yes, it's a little more than minor, so that's why we wanted to draw a distinction between those two.

MR. BURTON: Okay. Next slide. Okay. As part of Option III during the subsequent license renewal period SSCs need to be brought within the scope of the rule and aging of structures and components age managed to ensure compliance with (hh)(2).

This is to ensure continued functioning of core and spent fuel pool cooling containment functions during loss of large areas of the plant to due to fires and explosions. These maintain that functionality during the subsequent license renewal period.

And as with everything else, details of what SSCs if any should be brought into scope would be discussed during this initial development of the regulatory basis to support a proposed rule. Next slide.

With regard to timely renewal, 10 CFR 2.109, under that requirement applicants who submit their license renewal applications no later than five years before the expiration of their current license are allowed to continue operation past license expiration date until the staff has made its safety determination.

At the same time aging management activity is necessary for the period of extended operation are required to be implemented only after a renewed license is issued. This creates a situation where a unit can enter its period of extended operation without a renewed license and without a requirement to have the aging management programs in place.

To address this conflict the staff proposes to clarify that licensees must have the AMPs in place before entering the period of extended operation and maintain these AMPs until a final licensing decision is made.

This rule clarification would ensure that safety is maintained during presumably the short timeframe between expiration of the current license and the staff's final determination on the application. Next slide.

CHAIRMAN SKILLMAN: Butch, if I can ask?

MR. BURTON: Yes.

CHAIRMAN SKILLMAN: Why does it take the discussion around subsequent life renewal to require these changes today?

MR. BURTON: We have had this situation as you all probably know with Indian Point, so it's a legitimate question that you ask. The question is, I think Araceli mentioned before, we have just a few more applications to come in for the first license renewal.

We think that we have probably put together enough guidance based on the Indian Point experience that we could probably, should that come up again, and we acknowledge that's a rare occurrence, hopefully it won't happen again, but it was resource intensive I'll say that.

And so we had to make a decision. We think that this is something that's worth clarifying at the rule level, at the level of a rule, but to insist on the few remaining people coming in and putting requirements on them now, particularly given where they are in the development of their applications and stuff, we had to kind of make a, I would say a judgement call as to whether it was worth trying to impose that on the current --

MR. LUBINSKI: And from a timing standpoint since we are looking at subsequent license renewal and looking at opening up the rule for subsequent license renewal, it's the appropriate time and this would be something that would apply in the first license renewal period as well.

And that would be what we would be exploring. Why haven't we done it before now? We had always had a process where we believed we were going to make licenses decisions before we hit that 40-year mark and the timely renewal was not going to be significant issue.

It just so happened that it became an issue at the same time we're looking at subsequent license renewals, so it just, the timing of such and opening up the rule at the same time seemed to be compatible.

CHAIRMAN SKILLMAN: Okay, thank you.

MR. BURTON: Okay. Now we're starting on the Option IV considerations and we expect a considerable amount of dialogue with stakeholders on the items in Option IV.

As we said before Option IV includes the considerations in Options II and III plus suggestions to include revisions specifically applicable to subsequent license renewal.

These include requirements to take actions to ensure that the effectiveness of Aging Management Programs is maintained through the SLR period and to consider reducing the time before an SLR application can be submitted for a review.

The details of what should be required would be discussed, again, as part of the development of the regulatory basis to support a proposed rule. This option also discusses the staff's approach to ensuring that current activities that could impact the CLB are properly coordinated with SLR activities.

This first suggestion was driven in part from the findings from the staff's AMP effectiveness audits, which Dr. Brady will discuss in a few minutes. The staff proposed a requirement for licensees to take actions to ensure that AMPs remain effective and these actions, there are actually three actions.

We are suggesting that applicants, or licensees require AMP effectiveness self-assessments, that they report to the NRC age-related degradation, and report to the NRC changes to their aging management activities.

We believe these requirements will ensure a consistent and timely feedback mechanism to alert both the NRC and the industry of changes and lessons learned in aging and in the aging management activities.

Providing this information is critical to the staff and our ability to have reasonable assurance of adequate protection in the 60 to 80-year period. It ensures continuous focus on aging management and its safety impacts, it improves the effectiveness and efficiency of NRC oversight and inspection activities while reducing the resources applied to these activities, and it provides an enforceable mechanism to ensure aging effectiveness is maintained at a high level throughout the period of extended operation.

It should be noted that the staff drafted a risk that acknowledges that the current rule does not explicitly require that aging effectiveness be maintained in the PEO and reinforces staff expectations that AMP effectiveness should be maintained.

I'll go a little more in depth into each one of the components of this suggested rule change, so if we can go to the next slide. The first component of this suggested change is for SLR licensees to perform AMP effectiveness and assessments.

This suggested requirement is not without precedent and NRC currently requires similar self-assessments for maintenance, fire protection, and emergency preparedness.

These self-assessments have provided important information to the staff in preparing or revising guidance and in making decisions that have the correct focus and we expect similar benefits for license renewal.

Information that can be gained from licensee self-assessments will provide valuable information to the licensee, to the industry, and to the NRC to assess the effectiveness of the programs and inform changes and improvements for --

DR. SHACK: Now I'm reading the audit report, I mean they're always talking about they're doing health reports on their programs, which I assume is this self-assessment, what's different from what you want here to what they appear to be doing now?

DR. BRADY: Well we found when we went on the audits that they do do health reports for certain systems and these INPO -- the systems that they will do their health reports on, it does not cover all of the Aging Management Programs, but they are doing self-assessments and that's a good thing.

MR. BURTON: Yes. Well what, and, again just to piggyback on what Dr. Brady said, what we found as part of the audits and you can correct me if I'm wrong, that in implementing the programs what they did was they incorporated them into their current onsite procedures.

And one of the things that we found when we went out to do the audits is that it wasn't obvious that they were in the procedures identifying that when there were issues they were in fact aging and it was difficult for us to pull from those procedures and the findings from those procedures as they were implemented, exactly the information we needed to make an assessment of how well this is actually being done.

So I think those were some of the insights and Dr. Brady's going to talk about that a little bit more, but we found that there were areas where the information gathering and exchange could be improved and that was one of the drivers for this particular --

DR. SHACK: Well I'd be shocked if you didn't find that.

CHAIRMAN SKILLMAN: What I think I heard you say, and that Dr. Brady will explain this or speak about this a little later, is that in reviewing the system health reports, while you've found a lot of information, you did not find a connection specifically to age-related degradation.

DR. BRADY: Exactly. These will cover everything about the system and just to tell you a bit more about what Butch was explaining, when we went to the plants we found their program basis documents.

These were large reports that were done at the time of license renewal. They were put on a shelf in the backroom and essentially had not changed since they got their license.

We did see how they had taken their Aging Management Programs, they had incorporated them into the plant operating procedures, large numbers of procedures and that often when they were license renewal implementation procedures they were locked so that they could not be changed without the approval of the license renewal manager.

When we looked at the procedures we see that there had been revisions, maybe eight revisions of a particular procedure, but when we looked at it we could not find any indication that this change was apart from operating experience or a change from lessons learned, from the implementation of their procedures, or from NRC guidance.

We could not see how lessons learned from operating experience, from NRC guidance, were being fed back into the Aging Management Program and how the Aging Management Program was revolving and capturing the feedback and, as we're saying, we think that Aging Management Programs need to be living programs that are constantly reviewing and taking feedback from operating experience.

CHAIRMAN SKILLMAN: Okay, thank you.

DR. BRADY: Yes.

CHAIRMAN SKILLMAN: Thank you.

MR. BURTON: Okay. Yes, next slide, okay. The second component of this suggested rule change requires reporting of age-related degradation to the NRC.

We believe this would ensure that licensee self-assessments consider all relevant aging concerns, whether generic or plant-specific and will help the staff and industry stay abreast of relevant operating experience.

This knowledge is essential for NRC to effectively regulate and oversee aging management in the SLR period. Next slide. The last of the three components of this suggested revision is the requirement to report certain changes to SLR aging management activities.

Again, this would ensure that the staff is aware of significant changes to aging management activities during the SLR period and we believe these changes would be subject to 50.59 requirements and the staff is assessing the effectiveness of 50.59 processes for this purpose including determining the correct level of detail in the FSAR supplement that's included as part of the license renewal application.

Next slide, please. The next suggested consideration in Option IV was the timing of SLR applications. The current requirements allow applicants for SLR to submit an application at the same time that it's entering its first period of extended operation.

The current timing does not allow sufficient time to implement and assess Aging Management Programs and gain knowledge and experience in the effectiveness of the programs.

For the staff to access the effectiveness of aging management activities in the second license renewal period sufficient information from aging management activities from the first license renewal period must be available to review.

The staff suggests a revision to reduce time before an SLR application can be submitted. We believe it provides more operating experience with the AMPs in the first period of extended operation. Next slide. Okay.

This is the last issue in the paper. We

didn't want to identify it as a suggested rule change, but more a description of how we are going to be coordinating our activities with the Japan lessons learned directorate that's currently working on some of the Fukushima stuff.

The staff recognizes that the outcomes of the JLD work will impact on subsequent license renewal. Currently the JLD is tasked with addressing the recommendations from the near term task force on Fukushima and is currently focused on seismic and flooding issues and will consider other external hazards in the future, that is our understanding.

The suggested consideration in the paper recognizes that the environment around operating plants, changes in ground water, changes in nearby industrial facilities, may have changed since they were first built and may have impacted the design or licensing bases.

Verification of changes to the surrounding environment will be important in the staff's ability to have reasonable assurance that plants can operate effectively in the subsequent license renewal period.

The impacts of these activities on subsequent license renewal are being considered as the

NRC continues its work. Any changes to a plant's licensing bases as a result of new regulations in this area will be carried forward into the subsequent license renewal period.

However, because of the timing of any new requirements that they may impact SLR re-licensing the staff intends to continue to coordinate these activities for subsequent license renewal, getting it --

MEMBER RAY: Well, yes, but I mean I could read that as saying a decision is made under, the post-Fukushima order one way whereas perhaps a different decision would be made for the post-60-year period of subsequent license renewal.

I'm talking about external hazards, for example. And, in other words, regulatory stability arguments could argue against doing a site update every ten years as proposed and that might prevail.

But operating into the post-60-year period might have a different answer and that's why I ask are you going to make it explicit, addressing this issue if it's not made moot by what's decided post-Fukushima, that's basically the question.

MR. LUBINSKI: And as Butch said in the

coordination effort our expectation is that when we're looking at this issue with, and I'll call it a Part 50 issue right now, as we're looking at that in response to Fukushima and we're looking at flooding, seismic, and beyond that, the rainfalls, ground water, any, you know, snow packs, other things that could impact the design basis is that as part of that analysis to determine whether or not it goes into Part 54 is also not just looking at every ten years, but looking at the longer term in subsequent license renewal, what about beyond 60 years, beyond 70 years, even beyond 80 years, how does that requirement play?

And we think as part of that decision you would make that decision at the same time. So that decision could come out when a Part 50 states, that says, because, and I'm not trying to prejudge, that we don't do it or we do it at longer time periods, but it would consider subsequent license renewal as part of that.

If it does not and wants to punt it back to us we will make sure that we have mechanisms in place to consider that.

MEMBER RAY: Well, you know, I've run hydro facilities that are 100 years old and I can tell you that it's when the re-licensing comes up, not any other time, that issues of downstream flooding and integrity, and so on and so forth really get addressed.

And I think the same thing applies here because there's such a slow change in, I'll call it the scientific understanding of the environment that there isn't any one time during the tenure of the license that you hold on a hydro facility, for example, or something so substantial arises that you'd say oh, well we're keeping track of that routinely during the course of the licensing. You do it really when you re-license a hydro facility.

MR. LUBINSKI: And I think in response to that I believe our current processes are more effective in that manner and I think it is even more important because we're still looking right now, I mean we have a current application under review for a new license.

If we were to make a decision to issue that license and allow the plant to start to operate I would not want to wait till 60 years to have them do this requirement to readdress, or even at 40 years, because what we're learning, our continuous learning in this area from the standpoint of the safety basis is we want to have them address that when the issue comes up, if a new report's issued about a new seismic fault, if we get new information about rainfall, about flooding, I don't want to wait until the 60-year mark to have that plant look at it.

I would like to have a requirement in place to look at it sooner.

MEMBER RAY: I understand the motivations, but I also understand how the system works and I'm just saying that if you've done it before fine, then it's trivial to acknowledge at the 60-year point updating it if there's any update to it.

But to leave it aside and say it shouldn't be addressed at that point is something I'm skeptical about.

MR. LUBINSKI: Yes, I can appreciate the skepticism, but I think that's more of a comment on the current process not on what we're addressing in subsequent license renewal and if that's an issue that needs to be addressed in the current process I think we wouldn't want to look at that.

MEMBER RAY: No, I see it differently. I mean I think, again, maybe it's my experience in other regime, but there's a period of time when you don't have to question every time somebody issues a technical paper on something.

But then there's an accumulation over decades and I think 60 years is the appropriate point here perhaps when you say wait a minute, we've got to look back and see, have we been keeping this up-to-date over this very long period of time.

It spans many, many generations of reviewers and so on. It's just not so easy to say oh, we've kept it up-to-date throughout and therefore it's up-to-date by definition.

MR. LUBINSKI: And I agree that, yes, we probably have a difference in the way we view that, but I think where we would agree hopefully is the fact that we think it is important to keep as something as we're looking forward in subsequent license renewal to continue to coordinate and monitor and take appropriate actions with respect to these two issues.

And that's why we felt it was important to put in this paper. We didn't want the Commission to think we didn't look at it at all. We wanted them to be aware that we did look at this issue and made a conscience decision that we want to continue to address it with respect to the current licensing.

DR. SHACK: Somehow out of this whole

discussion though I still don't get an answer to John's question of what is addressed in the update to the FSAR with relation to this?

MR. LUBINSKI: Yes, and from that standpoint is there a specific requirement in place that requires them to do the analysis, the answer is no. When they do become aware of information they will look at the information and provide it in an update to the FSAR at that time.

But this would put more clarity and more transparency to what the requirement is as well as looking at what frequency in which they would do those reviews.

DR. SHACK: Yes.

MR. LUBINSKI: We have had plants identify previously, whether it's new flooding information, seismic information, rainfall, and they have updated that as they became aware of it and done that analysis and that was well prior to March of 2011 when they were doing those types of updates, but there was not an explicit requirement somewhere that would require them to do that in any frequency.

MR. PHAM: Yes, the 50.71 requirement for updating the FASR is more or less a reporting requirement. The content of what is updated is driven by other aspects, for example, GSI 199 if it's an applicable plant or other --

DR. SHACK: Well I mean I can understand GSI, you know, but that's a bid deal thing. I think John was more worried about incorporating sort of, you know, you don't find new faults or, you know, USGS doesn't sort of change their thing, but you get weather data all the time and is that updated or not? I mean --

MEMBER BROWN: Well how about Fort Calhoun almost, didn't they challenge their current licensing basis with the flooding they own? Has the FSAR been revised to take that into account and reevaluate their defenses against that flooding event?

I mean that's been what, a year and a half. I forgot, was it last, I've forgotten the timeframe, it was at least a year ago I think.

MALE PARTICIPANT: 2011.

MEMBER BROWN: And that was -- Okay, it was oh, two or three years ago. And I mean you could, you saw the pictures of it, I mean. Now based on what you're saying if our current process covers this they should have gone and said hold it, we almost violated our current licensing basis and got flooded out, what do we have to do? We redo our FSAR and get on with it.

MR. PHAM: Yes.

MEMBER BROWN: So I guess my question is have you seen a revision to their FSAR to take into account the fact they almost violated their licensing basis?

MR. PHAM: Well as I understand it that is what the efforts of the JLD, folks looking at seismic and flooding right now is trying to address is there --

MEMBER BROWN: Well but this is the licensee, forget what the JLD and the NRC, the licensee had a problem. He came close to flooding out.

MR. PHAM: Yes, right.

MEMBER BROWN: Now that means his original design, his original analysis said well, gee, we're good, this is the meteorological -- Yes, I'll get his out -- the rainfall and other upstream effects are always going to be in this particular realm and we're okay because we've got margin based on our analysis.

FEMALE PARTICIPANT: No margin.

MEMBER BROWN: Well we can argue whether they had margin or not since they had, you know, mucho quantities of sandbags trying to keep the water from getting into critical parts of the plants.

So has the FSAR been done? It's been three years ago.

MR. LUBINSKI: The direct answer to your question with respect to Calhoun, I can't answer what was changed in the FSAR and what the update was, but the more general answer is, is there an explicit requirement in the regulation that requires them do that? The answer is no, there is not an explicit requirement.

As Bo was saying is if they were to take action, identify that they were challenged or had new information and then changed their licensing basis, which we got across earlier, the fact that the licensing basis does change, that would be reported to us and the FSAR would be the place we'd get that information.

They could do that and they change their licensing basis based on a voluntary basis and once it's incorporated into the FSAR it becomes part of their licensing basis, but there's not an explicit requirement that requires them to look at the rainfall every year or every six months, every five years, and that's why --

MEMBER BROWN: I'm just looking for something that takes action on a current event, not that you have some long-term evaluation overall, I mean that's a specific event that show they were vulnerable.

MR. LUBINSKI: With respect to a current event if they were to identify that issue the NRC would look at what actions that are taken. There's not a specific requirement that says this is your new licensing basis. They would do the analysis.

MEMBER BROWN: I understand that.

MR. LUBINSKI: Then if we do not believe as part of oversight program they took appropriate action we can order them to change their licensing basis to that new requirement and make the changes, so we handle it on a case-by-case basis and answering your question I can't respond --

MALE PARTICIPANT: Yes.

MR. LUBINSKI: -- into details, we can come back and have other folks respond what happened in Fort Calhoun, but I'm talking from a process standpoint.

If we do not believe the licensee has handled that information and made the appropriate changes and it was a safety issue we would issue an order and take appropriate action.

MEMBER BROWN: Yes, but --

MR. LUBINSKI: If they have taken

appropriate action it becomes part of their licensing basis and then we would continue to monitor that moving forward.

MR. BURTON: Yes, and let me piggyback on that a little bit, okay. First of all, and this is specifically for Fort Calhoun, it already has its renewed license. In fact, Fort Calhoun was the very first plant to institute at that time was a new process called GALL.

But let's say Fort Calhoun did not have its renewed license yet. The way that the current process works is that they would address the flooding and they would make whatever changes to their licensing basis they needed to make in response to that, either through, you know, if there were orders or requirements or whatever it is that we had them do.

When that becomes part of their current licensing basis from a license renewal perspective that CLB carries forward into the extended operating term. So when we deal with what I call right now problems, which is kind of what you're describing, we deal with that with our processes right now.

And whatever ultimate changes occur to the licensing basis that's what gets carried forward. So from a license renewal perspective that's how the process works. I don't know if that gets closer to what you were asking or not.

MEMBER RAY: Well, look, both Fort Calhoun and Fukushima would update their safety analysis to reflect something different than what they had before the event.

We're talking about trying to avoid events like Fort Calhoun or like Fukushima, that's what we're talking about here. Anyway, I think we've said enough.

MR. PHAM: Yes, I'm finished you can go on.

CHAIRMAN SKILLMAN: Let's move.

MR. BURTON: All right. Yes, okay, now we're going to talk about the non-concurrence that was filed with the SECY. The non-concurrence requests that the staff provide to the Commission an option in the paper that requires applicants for subsequent license renewal to include an upgraded probabilistic risk assessment in the SLR application.

The request was based on a belief that having an upgraded PRA for SLR applicants would be consistent with the Commission policy on the use of PRA, would provide an opportunity to establish consistent PRA requirements for the current operating fleet and future combined license holders who seek renewed licenses, and would better focus resources on risk insights, smart inspections, aging susceptibility and integrated plant consequences, some of the items mentioned in the non-concurrence.

Next slide. There may be benefits to the risk insights that can be provided by a PRA. However, the staff decided not to include this option in the SECY paper for several reasons.

First, the non-concurrence, rather than resolving an inconsistency between the use of PRAs between new and operating reactors instead highlights inconsistencies between the use of upgraded PRAs for subsequent license renewal versus other operating periods.

No justification was provided for why the proposal was unique to the 60 to 80-year operating period versus other operating periods, but --

MEMBER BLEY: Can I interrupt you --

MR. BURTON: Oh. Sure.

MEMBER BLEY: -- right at that point because I got a little memory of a few minutes ago we were talking about putting things in to supplemental license renewal to make sure we've covered the things that are kind of scattered around and might not be all the way up to date.

I see a real similarity here. Just go ahead, but I --

MR. BURTON: Oh, okay. Okay, well --

MEMBER BLEY: It seems to me the same kind of thing.

MR. BURTON: And I think the next thing that I'm going to speak of may start to hit at that issue.

MEMBER BLEY: Okay.

MR. BURTON: We think that these are important questions and important considerations and they should be considered, but they need to be considered in the proper venue.

And we wouldn't consider PRAs and risk insights that require a more holistic framework to look at to be appropriate specifically for subsequent license renewal.

A more holistic assessment and consistent approach to the use of PRAs across all the NRC's regulated activities we feel is a better means of addressing the topic than the narrow SLR focus that's proposed in the non-concurrence.

NRC, as you all know, has initiated

activities to develop options to look at more holistic risk management regulatory framework to adopt a more comprehensive risk-informed performance-based regulatory approach to all of NRC's activities.

The current processes, and we think these current processes are a better means to vent these issues than specifically through subsequent license renewal.

The final reason that we didn't include it in the SECY paper is that current license renewal applicants can use risk insights in developing and implementing their Aging Management Programs right now.

The non-concurrence stated as such in referring to the statements of consideration for the current license renewal rule where it says that PRA methods and techniques would focus regulations and programs on those items most important to safety by eliminating unnecessary conservatism or by supporting additional regulatory requirements.

So we feel like there is already an opportunity to consider risk insights in the development and implementation of Aging Management Programs. And, to go further, at this point we think we'd be to some extent bypassing the processes that are already in place to consider PRA on a wider basis --

MEMBER BLEY: Just a couple of comments.

MR. BURTON: Yes.

MEMBER BLEY: That's certainly true. The opportunity is there. The non-concurrence also pointed out that under Part 52 the new licensees coming that route have to have a PRA and that this would make things more consistent.

The other thing is, to me, a lot of these issues beyond 60 years have a real probabilistic underpinning. Now you've addressed that through the use of expert panels and that sort of thing to some extent and the formalization of that might offer some advantages, so I just wanted to put those comments out first.

MR. BURTON: Okay.

MR. LUBINSKI: If I could, if you don't mind, Bo, if I could add this, and this gets back to your earlier comment about distinguishing the difference between what we're looking at and Options II, III, and IV versus why the PRA wasn't included there.

When we looked at the options under II, III, and IV we went with the premise of we were focusing on those issues related to aging. So the majority of those issues associated either with license renewal or aging or time-sensitive information when we talk about changes to the CLB.

When you look at the PRA, and I'll call it a PRA requirement, if there was a requirement to have an updated PRA maintained and submitted to the NRC at the time of subsequent license renewal where do you see the benefits of that?

And I would say that the larger benefits that you're going to see are either in the active component area or in the design change area. Areas that we said from looking at subsequent license renewal would not be in the scope of changes we'd be looking for in subsequent license renewal.

So if we were to keep that same philosophy on what insights could we gain from the PRA related to subsequent license renewal it would only be those related to the aging management issues involved.

So that's where we looked at the benefits from having the updated PRA to be something that were more applicable and more beneficial to areas outside the scope of subsequent license renewal.

And if that was the basis that is something that should be handled outside of subsequent license renewal in the current forms that we're looking at and Butch had mentioned of areas where we could benefit from PRAs. If we're trying to draw consistency with Part 52, again, waiting until 60 years to do that doesn't seem to be the timeframe.

Instead, having some other timeframe established to do that, whether it's, you know, a graded approach over time where licensees adopt this or at some point in the future because again it gets to the point of what's magic about 60 years at that point? And with respect to PRAs, the benefits, we don't see that benefit right there where we would see it across the board and we'd see it today.

So we're not saying there are not benefits to PRA, we think there are benefits, and if we're trying to look towards a consistency we should look at it in another venue, not tying it to subsequent license renewal and tying it to the 60-year point. So that's the --

MEMBER BLEY: I guess for me my definition of PRA is a little more broad than what we usually see in Reg Guide 1.200 and if I were to lean toward wanting a PRA to support subsequent license renewal it would be one that would include some kind of probabilistic treatment of some of the aging of older structures and equipment.

And somewhere along the line recently I saw somebody say nobody knows how to do that, but there's been a lot of work in probabilistic treatment of these sorts of things for the last 30 years or more and I think there could be a real benefit if that were the focus.

Now the way, John, you presented it, it wasn't that kind of a look and I'm not sure if the non-concurrence raised that issue with any clarity, but it seems to me that's a place it could be --

MR. LUBINSKI: And I wouldn't disagree with that and I would even go further to say if someone were to look towards putting that as a requirement for subsequent license renewal to have the PRA and to look at it from the aging management, could there be benefits from an aging management, and the answer is yes.

I would also say if we were doing that though we would take a step back and have to re-scope what we're looking at in subsequent license renewal. Are we then saying that we would require people to also make design changes based on the PRA to have design enhancements?

Would we be requiring them to make other changes to active components which are not part, right now scoped into subsequent license renewal? So I think if you look --

MEMBER BLEY: Well I guess in some of the license renewals we've seen come across not subsequent are the one's we've already seen. There have been design changes to make sure the plants could extend their life.

MR. LUBINSKI: They made design changes and they normally made that not part of license renewal, but that's been part of their current operating and they just carry forward into license renewal. And I'm going to, I know John had to leave, but he asked a question about the quality of the --

MEMBER BLEY: Yes.

MR. LUBINSKI: -- risk assessments with respect to SAMA, and let me use that as an example is, again that's a NEPA requirement to do the SAMAs. I'm not going to get into the legal issues associated with that, but let me talk from the standpoint of when those SAMAs are submitted to us and we look at them.

We look at it from the standpoint are there any cost beneficial changes associated with the Aging Management Programs. In doing that they do a cost benefit analysis across the board to those that are related to the non-aging programs.

There is not a requirement that they enhance those, or implement those cost beneficial enhancements. So, again, from the standpoint of license renewal that's been a philosophy we have followed that said they're not required to.

So carrying forward into subsequent license renewal that would be a change to the basic premise to say now you are requiring those cost beneficial enhancements and if you were to do that, put PRA in place, I would say that you'd have to look again at that same philosophy.

Are we requiring cost beneficial enhancements to be performed as a result of SAMA or the new PRAs and make it an explicit requirement? Because PRAs, great information, the question is what do you do with it and what do you require to be done with it?

And that's the next of that. It's not just require someone to submit a PRA, but I think you need to look at what are you going to require them to do when the information comes in? What are the expectations and what are the requirements for changes to the plant?

And I would say that, from the quality of the reviews that are done, I know that during our next panel folks from the Division of Risk Assessment will be talking and if, you know, I'm sure they can be able to answer questions in SAMA space as far as the quality of the risk assessments that they look at there.

DR. SHACK: Well John wouldn't be happy with the quality of the risk assessments, that I can pretty much assure you. But it is interesting that many of those non-cost beneficial things are showing up in, as adequate protection elements of mitigation.

MR. LUBINSKI: And from that standpoint, you know, again, from the standpoint of cost beneficial versus adequate protection and that's a different issue, the two are different.

CHAIRMAN SKILLMAN: Thank you. Butch?

MR. BURTON: Okay, with that I'll turn things over to Dr. Bennett Brady who will begin the discussion of the staff's review on the license renewal technical framework. Thank you.

CHAIRMAN SKILLMAN: Dr. Brady, before you begin, may I ask this question please? Would you or would anyone like to take a 15-minute break now before --

DR. SHACK: Yes.

CHAIRMAN SKILLMAN: -- we enter the next section?

(Laughter)

CHAIRMAN SKILLMAN: I'm going to declare a 15-minute break. Please come back at five minutes to 11.

(Simultaneous speaking,)

CHAIRMAN SKILLMAN: At five minutes to 11 on that clock.

(Whereupon, the foregoing matter went off the record at 10:37 a.m. and went back on the record at 10:55 a.m.)

CHAIRMAN SKILLMAN: We are back in session. Dr. Brady.

DR. BRADY: Thank you. I'm Bennett Brady. I'm a Project Manager in the Division of License Renewal, and I'm Butch's counterpart on the technical side.

For the briefing today, our goal is to provide you an overview of the development of the framework for subsequent license renewal. And as John has mentioned, Butch has mentioned, the development of the technical framework is proceeding in a parallel path while we are developing the regulatory framework.

We don't have to wait for a decision on the regulatory side to begin looking at all the technical issues. And our goal is to determine if it is feasibly possible to develop a GALL for subsequent license renewal that will address the aging management programs for us beyond 60 years.

Currently we use the GALL as, it's like a topical report for the license renewal process. We found that our current framework for subsequent license renewal has worked well for us, so we expect that our GALL for subsequent license renewal in the SRP, for subsequent license renewal will be very much alike the current GALL, GALL 2, and SRP 2.

However it will expand on those two documents. And we're using the GALL 2 and the SRP 2 as a starting point and template for subsequent license renewal. Next slide please.

We've developed a very what we consider disciplined, rigorous process in developing the technical issues. First of all, we've tried to identify all the sources where we might find recommendations, issues, comments for changes to our license renewal guidance.

And we've collected a lot of issues.

Second, we also developed a technical issues database in which we have collected all the issues that we could find on the technical side.

In this database we have cataloged all the issues according to the section of the GALL, AMPs, or the line items, or sections of the SRP, where there would be changes if we decide to disposition and accept the recommendation.

The third thing, we have set up around 90 expert panels from NRC staff, from my division, Division of License Renewal, other divisions, two divisions from the Office of Nuclear Regulatory Research, and from all four regions.

And these are staff, they've been selected because of their technical expertise in the particular issues we will be addressing, and also folks by their teammates selected. These are people that they think will work well in a team environment.

We are just now beginning our deliberation of these, and about a week and a half ago we began holding our expert panel meetings to disposition these issues. We've also developed under contract what we call the SLR GALL production tool.

It's not an automated method, but it's a way of linking the issues in our database to where they go, where they would be a revision in our GALL and SRP for subsequent license renewal.

And we will use this tool when we get ready to develop the draft GALL and draft SRP, and then long after that the technical issues, technical bases, and response to public comments document.

As mentioned earlier, industry says that they expect to come in with the first application for subsequent license renewal in 2018. And we estimate it will take about two years for an applicant to develop their application for subsequent license renewal.

Thus we have to complete, and have in place, our guidance documents by 2016 which means working backwards that we should have our draft guidance out in 2015 is also mentioned. We will be coming to the HRS to tell you about our findings before then.

CHAIRMAN SKILLMAN: If I could ask this question please? Is there anything in the present consideration for your effort where at some point the collective leadership simply says, you know what, there isn't enough substance here to warrant --

DR. BRADY: Yes.

CHAIRMAN SKILLMAN: -- a new GALL. Let's

stop. Let's stick with what we've got.

DR. BRADY: Yes, we recognize that that could happen, and that's why I mentioned we were looking at the feasibility. We may come to a point where we say that just, like by coming today sir, is there too many open items?

Plus to come at this point, we may say that there's too many technical issues. Maybe we should put it aside until there's more technical basis.

And that kind of begs that I should mention that, it is industries responsibility to provide us the technical basis to show that we can manage aging beyond 60 years.

CHAIRMAN SKILLMAN: What I was referring to though wasn't so much let's quit or it's too big, we can't handle it. But rather the tools that we have now are adequate. We really don't need new tools. Is there something in the decision making that will permit that route?

MR. PHAM: When you say tools, are you referring to the GALL?

CHAIRMAN SKILLMAN: The GALL. Yes.

MR. PHAM: Yes.

CHAIRMAN SKILLMAN: You see, you know what?

The present GALL's great. We don't really need an update, or we just need a minor adjustment here, and a minor adjustment here. But all the rest is just fine. Let's stop.

It sounds like 90 expert panels, that's going to take a lot of time and energy. It's going to take people's lives, it's going to take them away from other activities. It may be greatly productive, but it might not be. And it could be very distracting.

MR. PHAM: I think, you know, and at least understanding or having an understanding, or lacking of an understanding, in some of the material issues that we know of today, and long term operation, I think we probably, I think we're open to that.

But I personally just don't anticipate a situation where we say, well we know enough about this that we can continue to carry on.

And so I think the decision that we are prepared to make, if we need to, is to go through this process to determine what changes need to occur on the other side.

And I think the likelihood if an outcome is to pull the plug, or whether to proceed or not on finishing up the technical framework is to say, do we really have enough information to make the call on whether we can go forward.

You know personally, but we need to follow the process, but personally I'm doubtful that we get to the point where we say, ah, we don't really need more information than what we have right now.

CHAIRMAN SKILLMAN: Well, I don't have an orientation. I'm just asking the question, if somehow the collective leadership were to say, you know what? We have what we need already. We really don't need to go through this extended effort. Could you halt? Could you say enough's enough? We've got what we need.

MR. PHAM: And I would --

DR. BRADY: That could happen, and then I expect that for some of our aging management programs, they will say the same. We've got the problem now, we'll have it in the future, we'll have it in 60, and what we're doing is adequate.

Right now we have a lot of questions and we need to do the due diligence to say can these questions be answered? Can we move on with a reasonable assurance that this we will operate safely after 60 years?

MR. BURTON: Yes, and I'll add that

ultimately what's coming out of these panels is going to be a determination for each of the AMPs.

Either it's good as is, or again, in order to be adequate for 60 to 80 years, good as is, good with some tweaks, you know, so maybe some changes, or there is nothing currently here that can address this and there may need to be a development in the new aging management program.

And again, if there is, there has to be the technical basis supporting each one of these decisions. So, that's what we hope to get out of these expert panels.

CHAIRMAN SKILLMAN: Okay, so, is there one expert panel for each --

DR. BRADY: There is one expert panel --

CHAIRMAN SKILLMAN: -- AMP --

DR. BRADY: -- for each AMP, correctly. And for one each section of SRP and each up on the line items.

CHAIRMAN SKILLMAN: Okay, Thank you.

DR. BRADY: Yes.

CHAIRMAN SKILLMAN: Thanks.

DR. BRADY: And I would just mention that there are two sort of categories of not knowing enough.

That maybe we don't know enough about the aging from 60 to 80, but we can develop a balance.

We can increase inspections and sort of what we'd call a bounding AMP. And then there may be other AMP's for which we just say we don't know, we have to stop and get more information.

CHAIRMAN SKILLMAN: Okay.

DR. BRADY: Where we need to do due diligence to address these issues.

CHAIRMAN SKILLMAN: Okay, thank you.

DR. BRADY: Next slide.

MEMBER BLEY: Let me just throw in an odd question to you. I know it's many, many years off, but still quite a few years before we have a passive plant actually operating.

But as you went through thinking about all these possible things that might be issues, did you go through any of the thought for what you might need to worry about specifically for passive plants sometime in the future? Or has that just not even arisen yet?

MR. LUBINSKI: Yes, I would say the direct answer is, is no we didn't consider from that perspective. However, we do believe in what we're looking at, and the way the answer is set up, you're looking at it from components and degradation mechanisms.

And we believe that a lot of this would be directly applicable when you start to look at the passive plants because of the knowledge gained in the experience of operation, because what you're looking at is your looking at --

MEMBER BLEY: The balance just might be a lot more delicate, so you might --

MR. LUBINSKI: I'm sorry?

MEMBER BLEY: -- the balance just might be a lot more delicate.

MR. LUBINSKI: That's true, but the point is that, you know, you're talking about materials. You're talking about the environments they're in, and you're talking about the degradation mechanisms.

MEMBER BLEY: Absolutely.

MR. LUBINSKI: And how this will time in the aging impact that, so I think we can get what I'll call more the raw data out of this that would help us determine from the standpoint of the passive plants how to address this.

CHAIRMAN SKILLMAN: Thanks.

MR. LUBINSKI: Thank you.

DR. BRADY: As I mentioned, we've identified a large number of technical issues, and we also, when we were considering where we might get issues, we conducted several studies and activities to find more of the issues and be sure that we were inclusive.

The first of these was the Aging Management Program affect. We saw this, which we've mentioned, I'll talk a little bit more about that. The Periodic Safety Review Summer Reports, I'll speak some more on that.

We've also looked at relevant domestic and international operating experience databases that we have here to look at international and national operating experience.

And lastly, the Expanded Materials Degradation Assessment. Dr. Gavrilas will tell you more about this, but there was a question, Chairman, that you had earlier about have you identified the most significant technical issues, components of subsequent license renewal, and this was a major study that did do that, identified the major degradation mechanisms and those for which we have little knowledge.

CHAIRMAN SKILLMAN: Thank you. I'll look forward to hearing that. Thanks.

DR. BRADY: Next slide. We also talked about the AMP Effectiveness Audits. We went to three plants that are already in their PEO. The purpose was to learn about how they have implemented their aging management programs, doing the PEO.

It was also, the second purpose was to look at how these aging management programs have evolved in response to operating experience and the revisions of the GALL.

These three audits were very productive in identifying a lot more issues and recommendations that we'll be considering. The expert panels have, as Butch had mentioned, they did raise a concern that we did not see.

The aging management programs evolving, taking insights from their inspections, from the changes that we are making to our revisions, to our GALL documents and operating experience.

We found that the program basis documents, the documents that they developed for license renewal were back in a back room and had not changed. And this reaffirmed our feeling that the option for, to look at the effectiveness of aging management is really a requirement for subsequent license renewal.

Next slide. We did a limited scope review of 14 periodic safety reviews summary reports. And from this we have, the main focus of this was to look and see if there were technical issues, new aging degradation mechanisms, or new components that are not in GALL that we should be considering for inclusion in our GALL.

However, to answer the questions that you asked before about the PSR, we did look at their regulatory process to see if findings that they were getting from the PSR reports would have been captured in an NRC's regulatory framework.

CHAIRMAN SKILLMAN: Could I interrupt you please?

DR. BRADY: Yes.

CHAIRMAN SKILLMAN: May I ask you to please describe what is the breadth of those PSRs. Are they from primarily French plants, or German plants, or a wide swath of European plants?

DR. BRADY: They were from nine different countries, and these were not the PSR reports themselves. These were the summary reports that the regulator prepares after this.

CHAIRMAN SKILLMAN: Yes.

DR. BRADY: So, it was limited. We can't make any conclusion to say we should go to a PSR framework or not. But it was, we did look at all these things that we see in these PSR reports, would they be captured in the NRC regulatory framework.

And for some things we found yes, there is a direct correspondence, for some it's a little different. But we did not find a, I think what you call a jewels, that this is something that we should consider for improving our regulatory process.

MR. PHAM: And they were, the breadth is there are several different countries. I mean, I can name a few, Korea, South Korea was definitely in there. There was some few French plants, Finnish, UK, and Czech Republic, I think.

And so it was, we base it around the availability of these reports, and you know how the ones that we did have translated versions to.

CHAIRMAN SKILLMAN: Okay. You had also, from the timing standpoint, these reports span different time frames, well plants that operated from 10 years up to 30 years? Is that right?

MR. PHAM: Yes. I've got to get --

CHAIRMAN SKILLMAN: Don't know that?

MR. PHAM: -- the summary numbers for that. Yes.

CHAIRMAN SKILLMAN: Thank you. Let's proceed.

DR. BRADY: As I've mentioned, we also reviewed domestic and international operating experience with the NRC databases to look to see if there were any new insights, aging failures that we should be considering.

And we did collect some new operating experience that had not been considered since GALL-2.

CHAIRMAN SKILLMAN: Could you expand on that please?

DR. BRADY: Well, one thing we found that there was a failure of a steam isolation valve due to the weakening of permanent magnets. Another one was we saw aging related and relevant emergency diesel generators.

CHAIRMAN SKILLMAN: Yes, thank you.

DR. BRADY: We did not find a lot of new experience, yes.

MR. PHAM: And we did, we tried to develop conservative in our best understanding of the context of the technical content, I mean, because sometimes the equipment referenced in the report may not, and by nomenclature, may not be translated directly, as applicable to the U.S. fleet.

But we tried our best to read into the context of what was captured in the reports, and when in doubt we basically put it into the technical issues database to further consider.

CHAIRMAN SKILLMAN: Okay, thank you.

DR. BRADY: This ends my presentation. If you have no questions Dr. Gavrilas will tell you about the Expanded Materials Degradation Assessment, and some of the key technical issues that we identified from that large expert elicitation.

DR. GAVRILAS: I'm Mirela Gavrilas. I am the Branch Key for Corrosion and Metallurgy in the Office of Research, and I'll step back just a little bit to discuss our role in the entire SLR process.

One of the most important roles that the Office of Research staff has is in canvassing the knowledge and collecting the state of the art for information.

In other words, we do the review of journals, we participate in meetings, when the topic warrants it we organize workshops. And a couple of years ago we co-sponsored with the Department of Energy, the third IAEA meeting on LTO, it's called PLIM.

In addition to that, we have routine interactions with the Department of Energy staff on light water reactors, sustainability, and we interact with EPRI staff as well on their programs, on their LTO program.

We have memoranda of understanding with both entities, separate ones. And the one with DOE will come into play because they were the co-sponsor for the EMDA that I will discuss in greater depth.

The EMDA, you'll hear us refer to it sometimes as the Expanded Materials Degradation Assessment, sometimes as the Extended Materials Degradation Assessment, because it actually did two things.

It extends the assessment operation. We had a precursor to it and some of you are very familiar with it. It was called the Proactive Materials Degradation Assessment, the new reg that was issued in 2007.

It covered piping and reactor vessel internals. So in the Extended or Expanded Materials Degradation Assessment, what we did is we took the findings and extended them for a window of time, 60 to

80 years.

We also broadened the scope to not include just piping and reactor vessel internals, but we looked at the reactor pressure vessel, we looked at structures and cable aging. Next slide please.

I'm going to discuss the issues in the order that EMDA, when it's going to be issued will have four volumes, and this is nearly the maiden voyage for these slides.

We gave one presentation to Commissioner Ostendorff last week, but it's the first time that we're summarizing the information in the way in which you see it today.

And I'm categorizing the degradation mechanism according to susceptibility, high susceptibility high level of knowledge, and the second, very different category, high susceptibility low level of knowledge.

In the reports themselves of course you'll see intermediate and low for both susceptibility and level of knowledge. But for the purpose of this discussion I thought that this is appropriate.

So let's start with volume one. And for your information the EMDA values are undergoing technical editing now, and we anticipate that next week we'll have them 99 percent done. At that stage we will be comfortable sharing it with the Committee, should you wish.

MEMBER BLEY: Is this essentially an update on 6923 or is it --

DR. GAVRILAS: Yes. An update on 69 --

MEMBER BLEY: Twenty three.

DR. GAVRILAS: Thank you. That has --

MEMBER BLEY: Looking at it. That's how I can remember.

DR. GAVRILAS: -- that has three extra volumes.

MEMBER BLEY: Yes.

DR. GAVRILAS: The reactor vessel, the concrete structures, and the cables. And that focus is on degradation mechanisms that can occur between 60 and 80 years.

So the key technical findings in the area of piping and internals are things that we've known, back up please. The previous slide. Thank you. High susceptibility high knowledge, these are things that we know how to deal with, broadly.

Inspection, maintenance, repair, replace, and what you see there are things that are very well studied. Stress corrosion cracking of 600 and its weld alloys, irrigation creep of stainless steel, fatigue of small bore welds.

What requires more thought on the staff's part and the industry's part of course, are the high susceptibility low knowledge scenarios. And the first one here is the one that I consider probably most daunting of everything that you're going to see.

It has to do with irradiation assisted degradation of vessel internals. And my view on that is, right now we have data to about 15 DPA, where DPA is a measure of fluence to the internals.

There are mappings that have been generated of the internals that show that at the end of 60 years, portions of the internals are receive, and are going to receive an excess of 100 DPA. So this is before it even enters the 60th year of operation.

What complicates things further is that there is a large variety of materials that are in these components, in various shapes, exposed to this broad gamut of radiation levels.

And from the staff's perspective, the programs to test what happens at these levels have a huge time lag. I mean, even with us going to the reader and harvesting materials, and we have a cooperative program where as I understand, which we are going to do just that.

So even if we go and harvest materials that have 50 DPA, we still want to put them in the ATR and give them additional bellows and test them, but those are long programs.

You know, because even with accelerated testing, real life they get about one DPA a year. I put it in the ATR, they get about four DPA a year. So it's a long time to go from 50 to where we'd like to be.

You asked, Dr. Skillman, in our telephone conversation in preparation for this meeting, you asked about the nexus between this research and the AMPs, and then the research program, so I prepared a bit of a summary.

This, the piping internals, the subject AMPs are the ones on BWR and PWR vessel internals, as you'd expect, and I hinted at the Zorita Program, that's a cooperation with EPRI, a cooperated element with EPRI.

We also know that there's work going on in the LWRS program on modeling, and simulation, and thermal aging. There's also work going on on crack initiation and nickle-based alloys.

And there's environmentally assisted cracking work that's also conducted by EPRI under the LTO program. I expect that you will hear more about all of these programs in the afternoon.

These are the programs that we know about because we're maintaining some level of cognizance of what's going on in them by various means. As far as NRC research is concerned, we have work on irradiation assisted stress corrosion cracking happening at both Argonne and Idaho National Laboratories, and again I'm mentioning the Zorita effort because it's so important to us. That's going on.

In the area of, and now we can go to the next slide please. Three of the degradation mechanisms that you see here are the top two, and the bottom left are all PWSCC.

In the area PWSCC, we have work going on at both Argonne and Pacific Northwest Laboratory, and we're exploring. The research programs that I'm going to talk about cover a spectrum.

Research that's been completed, or near completion, research that's ongoing, well on the way, and research that's in exploratory phases. And one of the research initiatives connected to PWSCC is we want to look at the initiation eventually, and that also we anticipate is going to be a collaborative effort with EPRI. Next slide please.

As far as the reactor vessel is concerned, I'll move you to the highlight of the slide. What you see there is a test reg, not a degradation mechanism. And that's because high probability low knowledge scenarios were not identified in this area.

We know about high susceptibility and high knowledge scenarios like embrittlement and stress corrosion cracking, and those have been looked at extensively in previous programs, and in the context of the PTS rule.

The intermediate, I added on this slide an intermediate susceptibility scenario. It has to do with a environmentally assisted fatigue low knowledge. Given how fresh the EMDA is, that it's just been finalized, this is an example of something that warrants further attention.

We're going to have to look at it and decide what we're going to do in terms of research, or what our expectations are going to be. Next slide please.

In the area of cable degradation --

DR. SHACK: Did you have Bob Odette on that panel?

DR. GAVRILAS: Yes we did.

DR. SHACK: And he agreed with high knowledge?

DR. GAVRILAS: Apparently. Mark, would you like to take that? No --

MR. HURD: There was a diversity of opinion among the --

MALE PARTICIPANT: Please identify yourself.

MR. HURD: Oh, I'm sorry. Mark Hurd, Office of Research. Yes, Bob, Professor Odette was on the panel. And yes, there was a diversity of opinion regarding the maturity of our knowledge and the need for additional work. Thank you.

DR. GAVRILAS: Thank you. In the area of cable degradation, what you see here is the high probability high knowledge scenarios, thermal aging of neoprene and ethylene type materials, and long term irradiation damage.

Just because we know the mechanism, in this case, this is an example of something where just because we understand the mechanism doesn't mean we're done with the issue, because knowledge is lacking with regard to what exactly these cables have been exposed to as they were sitting in the plant.

And I know that the industry has efforts in the direction of actually trying to figure out what various components were exposed to. High probability low knowledge scenario is what happens to low and medium voltages when they're submerged for a long period of time.

And in both areas we have significant work going on as I mentioned. The industry is looking at trying to figure out what the actual service environment of the cables that are in service now has been, and industry is also looking at containment cable temperature and radiation levels for representative cables.

And as far as the staff is concerned, we have work at NIST and at the University of Maryland on cables harvested from Zion. We're going to verify condition monitored tests, and validate service life's prediction models that are being used.

We also have work at San Dia, and that work is nearing completion. That deals with cables and submerged environments. We expect a final report on that to be issued this year.

MEMBER BLEY: I'm just curious about the cables you've collected from Zion. Were they submerged for their whole lifetime or do you have a real history on wetting, and re-wetting --

DR. GAVRILAS: I have my lifelines in the audience, so Sheila Ray can take --

MEMBER BLEY: You get one.

DR. GAVRILAS: -- take the question.

MS. RAY: Hi, I'm Sheila Ray. I used to be in the Office of Research and work on cables, but the cables we are getting from Zion, we are not getting submerged cables at this time.

We know there are some cables that were submerged from the turbine building, but --

MEMBER BLEY: But these aren't the aren't the set you have?

MS. RAY: No.

MEMBER BLEY: The set you have been dry.

MS. RAY: We're more concerned with the cables in containment that were exposed to temperature and radiation environments.

MEMBER BLEY: And you have a temperature and radiation history on them of some sort?

MS. RAY: We have a range. We don't have the paperwork, but we have talked to some of the staff that used to work at Zion, and we have a range of temperature and radiation, which is good enough.

MEMBER BLEY: All right. Sorry, we have someone who knew it well.

DR. GAVRILAS: Thank you, Sheila.

MEMBER STETKAR: Mirela?

DR. GAVRILAS: If you have. I'm sorry.

MEMBER STETKAR: On the wetting, you characterized that as low knowledge, that also is based on everything that EPRI's done?

DR. GAVRILAS: That --

MEMBER STETKAR: For the wetted cables?

DR. GAVRILAS: The panels, this is one thing that I didn't mention about these panels. These panels were assembled to not only contain international expertise, but to be diverse in make up.

In other words, have people from the industry from the regulator from the academia. So we tried to assemble the panels so that we have the broadest reach possible in terms of technical subjects. So --

MEMBER STETKAR: You had representatives

from EPRI on the cables in particular?

DR. GAVRILAS: You're making me look into my backup slides --

MEMBER STETKAR: Indeed.

DR. GAVRILAS: -- and --

MS. RAY: This is Sheila Ray, yes we did.

DR. GAVRILAS: -- yes there is.

MEMBER STETKAR: Thank you.

MS. RAY: Yes we did.

DR. GAVRILAS: Mr. Tummond was. Okay so --

DR. SHACK: It was a diversity of opinion, no doubt.

DR. GAVRILAS: Not as much as on the reactor --

MEMBER STETKAR: I'm just surprised that that's characterized as high knowledge, and this is characterized as low. That's all.

DR. GAVRILAS: We tried to be as systematic as possible. The panels where, and I think it depends on their individual experience, how much they were able to adhere to the PIRT process that we tried to have them follow.

And how much of a cultural sort of ingrained belief they brought to the table, and whether they could even look at it from a PIRT perspective. So you'll see variation.

I think that the piping panel had a great advantage because many of them had been through it before, but some other panels like the cables and concrete were not in the same position.

MEMBER BROWN: Could I ask one question --

DR. GAVRILAS: Yes please.

MEMBER BROWN: -- relative to the data on the cables? I mean, if you get temperature and irradiation data, that's one thing. But cables have a wide range of what I'd call internal currents that are generated.

So you have internal cable heating that can have a fairly strong, very strong impact on what the external environmental temperatures and radiation have. At least that's based on my past experience and --

DR. SHACK: It's true here too.

MEMBER BROWN: -- you don't consider, I mean, it seems to me you have to consider the application and how much cable heating you had to go along with that during its application.

DR. GAVRILAS: We have Sheila back to the microphone to answer the question, but I've --

MEMBER BROWN: I just wanted to know did they consider that? That's all.

DR. GAVRILAS: Okay.

MEMBER BROWN: I don't need to go into excruciating detail, but were the application, the current loading, cable heating incorporated as part of the evaluation?

MS. RAY: This is Sheila Ray, no we don't consider that because if the cable is designed properly, that is not an issue.

MEMBER BROWN: Okay. I would argue with you.

DR. GAVRILAS: Let me make an offer. As I mentioned at the very beginning of this meeting, if you want to hear more about the details of the EMDA report, this is not the right panel. I'd probably be sitting at that table and you would have Sheila and --

MEMBER BROWN: She answered my question. Okay, it's just --

DR. GAVRILAS: -- Mark, so --

MEMBER BROWN: -- I would just disagree with it based on cable testing that I did back in the 80s, okay. And in the 90s, when we were trying to assess whether we needed to replace cables in Navy ships, and particularly that stuff and the rats --

MALE PARTICIPANT: Badly designed, what can I say.

MEMBER BROWN: Let me tell you. If you could have tested it without running 1,000 AMPs through it, it didn't, made a lot of difference.

DR. GAVRILAS: So if you don't mind, we're going to approach you all after the meeting --

MEMBER BROWN: No, no, no. That's fine. You answered my question. You didn't have it.

DR. GAVRILAS: Okay, great.

MEMBER BLEY: We'll see you on EMDA I guess, and --

MEMBER BROWN: But I think that's one, you can rest assured we'll dig into a little.

MEMBER BLEY: Yes.

MEMBER BROWN: That smells really odd to me.

MR. LUBINSKI: Yes, we really appreciate that comment because again --

MEMBER BROWN: Worse than odd.

MR. LUBINSKI: -- as we said, we'll be back to talk with you folks again in more detail. And as Mirela says, we'll have a different panel here when we go through that discussion.

But you know, we're definitely, we appreciate hearing those questions and comments today so that we can make sure that we can appropriately address that to you at a later date.

CHAIRMAN SKILLMAN: Let me make a comment. I thank Bennett and Mirela for the effort that you've put in. We had a pre-call, as you all might understand. And the question I posed is, where's the data, where's the practical stuff, where's the foreign operating experience, how is that factored in?

And I said I'm comfortable my colleagues are going to ask questions about that, and you are providing the type of information that I was hoping that you would. And I thank you for doing that.

(Off microphone comments)

CHAIRMAN SKILLMAN: And I'm sure we're going to probably lead to another discussion, but these are the types of images that, at least in my mind, begin to set us into thinking about can we really take a plant that looks like this to the first day of the 61st year.

You know, what's with this plant? Is that stuff okay? And I think those are the types of questions this team needs to be asking. But thank you for your effort to bring this up here. Thank you.

MEMBER STETKAR: Mirela, one more thing on the cables though because you mentioned that you're trying to get information from Zion focusing on environmental conditions, radiation exposure, temperature inside the containment, location of the cable, things like that.

If indeed current loading of the cable was important, there are ways that you could mine that information too, knowing what it was. And if you're trying to get that information now, you might want to add that to your laundry list.

That's one of the reasons for having these conversations earlier rather than later after you say, well, we finished everything.

DR. GAVRILAS: I jotted it down as an action item for us to follow up on that. We can go into the next area, next slide please, which is the final volume of the EMDA that has to do with civil structures. And you will see under high probability high knowledge, you'll see the freeze thaw damage that we've seen in the '70s at Davis-Besse.

I understand that there's been a Canadian plant that had a similar experience about ten years ago.

ASR is the second bullet over there, and they I saw as an example, you know I was talking to my colleagues in research during the break, is an example of something where we understand the mechanism of how the gel is formed, but we don't know what its impact is on the structure of properties of the structure.

So that's work in progress and I'll talk about that in a moment. And stress corrosion cracking of steel reinforcement bars and tendons, all those are high susceptibility high knowledge.

Under high susceptibility low knowledge, irradiation damage to concrete, we've treated temperature as a surrogate for irradiation. We're now wondering if that's appropriate.

Boric acid corrosion, I understand a crack developed in the liner of the Salem pool and the boric acid, the borated water that leaked into the concrete caused damage to the concrete.

And finally corrosion that initiates at the interface between the liner and the concrete. And that's an area that we studied, the staff studied in some detail.

So again, we understand the mechanism very well, we're linking it to the presence of a foreign object, but the lack of knowledge comes in, are there foreign objects out there. So, we don't know about those.

MALE PARTICIPANT: There's too many.

MEMBER BLEY: Yes. If we basing it, yes they are.

DR. GAVRILAS: We know they are because we've seen them at Beaver Valley, for example.

MALE PARTICIPANT: Yes.

DR. GAVRILAS: In terms of research going on, again I'm going to assume that you'll hear much more from DOE and EPRI on these programs in the afternoon, but we know that there's work done on NDE of concrete in the sustainability program at DOE.

And we know that there's work on the effects of boric acid and radiation damage that's done by EPRI. Our work is, we are having NIST look into the impact that ASR has on structural properties.

We just approved a long term research program that is looking to sort of examine the factors that go into evaluating what's the remaining service life of concrete structures. We anticipate that as being an important and involved effort.

It will include NDE. We're in the

exploration phase on monitoring dry storage casks that will probably inform these efforts, and we have work at Oak Ridge National Lab and University of Houston that was completed in 2013 on irradiation effect strategies and remaining issues for LTO. And that concludes --

MEMBER BLEY: I'm just curious.

DR. GAVRILAS: -- my presentation.

MEMBER BLEY: Is there anything we learned from other industries? With other structures that have been out there for a long time?

DR. GAVRILAS: We have a head's up that this question may be asked. So if we have learned if --

MEMBER BLEY: I hadn't even thought of it until just now.

DR. GAVRILAS: Well, your colleagues know you well. We have, by assembling these panels the way we did, we are hoping that their expertise reached out into other industries and they brought their knowledge to the table in cases in which it was applicable.

MEMBER BLEY: The staff hasn't pursued that looking at other industries?

DR. GAVRILAS: Not outside of these panels, as far as I know. But there's another thing that in conclusion, if I may mention one other thing, it's that there were no surprises when you see the high susceptibility high knowledge, or high susceptibility low knowledge.

Nothing that we've seen came as a surprise to the staff. And we believe that is because the staff has been proactive in keeping abreast of what's going on in the industry and monitoring laboratory experiments, all the sources of information to have a basis for going forward. You have any additional questions? Yes?

MEMBER BLEY: Do they try to make any judgement as to whether the current aging management programs that one proposes for this would be able to deal with these problems, are they --

DR. GAVRILAS: These problems are now put into Bennett's database and they're going to be evaluated there. And if the staff should find that we need more information along those lines, we are going to reach out to experts again and try to --

MEMBER BLEY: Yes, at least the high susceptibility and high knowledge ones are problems that all civil structures --

DR. BRADY: We took two things out of the EMDAs. First was their prioritization. We have informed the expert panels, hey this was something that was high susceptibility low knowledge.

Just think up here, think hard on those things. We also read through all the background papers and reports of the EMDA to looking for suggestions for including aging management, and we have put that in our database for consideration.

MR. PHAM: Okay. I think you will also find that the industry may have a different perspective of what's their aging management program versus what the staff believes as well.

DR. SHACK: Right, I mean, and then there's a difference between understanding a mechanism and an aging management program.

DR. BRADY: Yes.

MR. PHAM: Yes.

DR. GAVRILAS: Yes.

MEMBER BLEY: That's right.

DR. GAVRILAS: Dr. Rempe, you had a question?

MEMBER REMPE: Yes. It's the same question I asked earlier. Again, it helps to have the perspective about the expert panels and the ongoing research. But again I guess I'd like, because I know we'll hear from other individuals later today, I'd like to hear your perspective with respect to the high priority items.

Is there research ongoing that will address it in a timely fashion? Are there some issues that you think no we just, you know, not enough's being done in time. And do you have any conclusions, summary type statements on that topic?

DR. GAVRILAS: I think that this is still early for any big conclusions, but I know that we have concerns. And I mentioned irradiation assisted degradation.

That's a concern that the staff has. There are others, but we're going to hear from, I assume that you'll hear from the industry. I know we had public meetings with them, so we know that they're working on it. And as more information becomes available, we'll know more about it.

DR. SHACK: Well, the final GALL in 2016 doesn't give you a whole lot of time.

DR. GAVRILAS: So I'm going to quote John Lubinski the third time in three presentations on this topic. And I'm sure John will tell me if I'm misquoting him.

At one point the question came up, so if this data's not available, he said that effectively we can proceed assuming that the component that's degraded will be replaced, and then revisit that decision once more data is gathered, and the component can be left to support leaving the component in service.

And I think that that's a pivotal philosophical approach. Did I misquote you? Am I in trouble?

MR. LUBINSKI: Not misquote, good paraphrase.

CHAIRMAN SKILLMAN: I guess I would agree with that except that you certainly got my attention on the irradiation assisted degradation of the internals.

And the real issue there isn't the internals themselves, it is the support that they provide for the fuel assemblies. And if for any reason there should be a slump, or a failure, you may not be able to insert your rods.

And so it seems that within that window of consideration, there will be some components where we would say you can't take a bye on that component until you know that component is fit for duty for, in this particular case, so much more neutron fluence. You see the point I'm making?

DR. GAVRILAS: Yes.

CHAIRMAN SKILLMAN: Some of the stuff you can say, well just change them out. I mean, that's why you have a thermal shield to protect your reactor belts from fluence.

But in the internals themselves, if you get to a point where we would consider the fluence so great that there's a passive failure imminent, either on the bolting or on the structure, we can't have rods that can't fly. The rods got to go in.

And so there is probably a subset within that discussion where there cannot be a bye. There needs to be confirmation that the component's good for the next increment of duty.

DR. GAVRILAS: And that is dialogue that the staff certainly intends to engage the industry in. I mean, we've heard it, we've mentioned it to them, they'll confirm that they heard this message from us, but that's all --

CHAIRMAN SKILLMAN: And I say this knowing, I know one plant with a thermal shield did fail. It did fall. It did have to be righted and removed, and so there is a way for the utilities to handle this.

But that was the thermal shield. That wasn't a core support device. So, I think there is a sub-element within this discussion that we need to know that the devices are fit for duty for the next increment. Thank you.

DR. GAVRILAS: Thank you. Yes.

MEMBER BROWN: Because of that I just, I hadn't heard anything about it, but the thermal shield, isn't there an issue or a concern with the changes due to irradiation for the reference transition temperature, from a brittle fracture standpoint on the vessels? Or are these, is there just so much water --

DR. SHACK: That's the high knowledge high understanding.

DR. GAVRILAS: Right.

MEMBER BROWN: Yes but, you know, after 50 or 60 years, I mean, I would expect your RTT to have come way down.

MEMBER RICCARDELLA: Yes, but that's monitored by ongoing programs. I mean there's --

MEMBER BROWN: Well could you --

MEMBER RICCARDELLA: -- surveillance programs that lead the vessel, and they're taking surveillance specimens out and testing them.

MEMBER BROWN: Wait, I remember seeing specimens that are stuck in, in one of our earlier --

DR. SHACK: Now the question might be whether we have enough specimens --

MEMBER BROWN: Yes, I was going to say --

DR. SHACK: -- to go this long. Since most of the people have used an awful lot of those already.

MEMBER BROWN: But I mean, is there any --

DR. SHACK: But the people are thinking about that.

MEMBER BROWN: Okay.

DR. SHACK: We haven't heard the answers yet.

MEMBER BROWN: Has anybody ever annealed a vessel in these programs?

MEMBER RICCARDELLA: Russia. They've done it in Russia.

MR. HAGGARTY: No.

MEMBER BROWN: Outside of the country where it happened?

MR. HAGGARTY: This is Ed Haggarty, sir.

CHAIRMAN SKILLMAN: Would you identify yourself, sir?

MR. HAGGARTY: Ed Haggarty, sir. There is an annealing rule in the red guide though, Charlie.

MEMBER BROWN: Okay.

MR. HAGGARTY: But it's never been --

MEMBER BROWN: So it's never been ruled --

MR. HAGGARTY: -- exercised. So --

MEMBER BROWN: So you've never had, based on these samples and everything else, you've never approached where you didn't have enough margin --

MEMBER RICCARDELLA: No, we should have a plant or two because --

MEMBER BROWN: -- to handle the next --

MR. HAGGARTY: The Europeans and the Russians have done that to some of their vessels.

MR. HURD: Mark Hurd, Research. I mean right now, you know, like Pete said, the surveillance capsules monitor the vessel out to well beyond where they're currently operating.

And right now we're not projecting any, no plant's going to go beyond the PTS limit or the alternate PTS limit, which tend to be the most life limiting factors for the vessel, even within the first 60 years.

So I guess I'd personally say I don't see that somebody would anneal when they have computational alternatives like the alternate PTS --

MEMBER BROWN: No, I understand that, as long as you have a good handle on the --

MR. HURD: Yes.

MEMBER BROWN: -- RTT. I understand that particular point. But you set out to 60 years and now we're talking another increment of 20 after that, and how --

MR. HURD: And there are efforts ongoing, and I think EPRI will be talking about it in the afternoon as part of the staff's review of Regulatory Guide 199 several years ago, and it's an ongoing thing. And that's the --

MEMBER BROWN: Thank you.

MALE PARTICIPANT: Very ongoing.

MR. HURD: And of course the, trying to do this straight --

(Laughter)

MR. HURD: -- that's the equations we use to predict the neutron embrittlement. We identified that there, while there's data out to high fluences, where high fluences here are talking in the six to eight E19 range, the data starts to get to get sparks.

So one of the things that our industry colleagues have done is they've taken that onboard, and they've implemented two surveillance programs.

One is to shift existing capsules out to higher fluences so that we get data, and the other is that to actually reinsert tested samples, and I think the EPRI representative will be talking about that this afternoon.

Additionally we've got ongoing efforts within ASTM Committee E10-02 on Nuclear Structural Materials to collect together a database not only of U.S. surveillance specimens, but also International surveillance specimens.

And since the international community is not constrained by the GALL guidance of removing their samples at 1.5 times EOL fluence, what you see in their data is that they've got data out, like in France, in Germany, and Japan and Korea, out to higher fluences than we do. We've compared the trends.

They're consistent, and so use of the international data through the ASTM code committees also provides us a mechanism for seeing where we're going.

MEMBER BROWN: Okay, thank you.

MEMBER REMPE: Isn't the material in the foreign vessels a little different than our --

(Simultaneous speaking,)

MR. HURD: Not substantially, I mean when you, well, it depends on what foreign country you wish to talk about. Countries of the former Soviet Union, then yes, absolutely.

But if you're talking about French vessels, or predominantly old Westinghouse designs, German vessels are predominantly B and W designs, the Koreans follow our regulations. Pardon?

MEMBER REMPE: I thought the material composition, even in the French ones, was a bit different.

MR. HURD: I'm not, not critically different. I mean, they have different, in Europe they have a different specification. They don't use ASTM A508 or ASTM A533(b) --

MEMBER REMPE: Right.

MR. HURD: -- but if you compare the chemistry tables, and compare the requirements, they're very, very similar.

MEMBER REMPE: Okay.

MEMBER RICCARDELLA: And we have ways of

adjusting for differences in chemistry --

MEMBER REMPE: Okay.

MEMBER RICCARDELLA: -- as well, when the critical comes.

MR. HURD: Yes, the embrittlement trend curve itself adjusts for the effects of chemistry. The main thing where you can't mix the different steels together, if you will, is when you get different embrittlement mechanisms controlling the shift in RT and ET.

And that's why one would treat the ex-Soviet steels differently than the western reactor steels, because they, in addition to the hardening mechanisms of copper-rich precipitation and matrix damage, they have an additional mechanism of non-hardening embrittlement through precipitation of, like, phosphorus and silicon at the grain boundaries.

So there you wouldn't want to mix and match, but the small differences in the spec between say, U.S. and Asian, and European steels and welds, is, we've done the work, and well, as Bill was laughing, the work is never done.

But we've done the comparisons within ASEM and actually found predictive equations that do, I'd say, an equally good job, or the more pessimistic might say, an equally bad job, on all of the different non-Soviet reactor countries.

CHAIRMAN SKILLMAN: Let's --

DR. GAVRILAS: I'm going to take --

CHAIRMAN SKILLMAN: -- proceed, okay?

DR. GAVRILAS: -- this opportunity to mention that this type of discussion, Mark is one of the people on the panels that we discussed. So these are the type of discussions that you can expect to happen in those panels.

CHAIRMAN SKILLMAN: Thank you. Let's move on please.

MR. LUBINSKI: Okay, thanks Mirela. Appreciate you finishing up the technical framework. So I'll just quickly go through a summary restating some of the things we've talked about already.

All the plans are required to meet their licensing basis during the initial licensing, during their first license renewal period, and will be required to do the same during the subsequent license renewal period.

We believe that the regulatory processes are effective for ensuring the licensing basis is met, and for identifying and resolving any new issues throughout plan operation. And as discussed, we know that during the first forty years as well as the first license renewal that the licensing basis does change and become enhanced.

And the aging management is reviewed during the initial licensing and it was expanded during the first license renewal. And we expect it to be further expanded during the subsequent license renewal period.

We believe that the suggested SLR framework we presented today creates a more efficient and effective process for the rule clarity for the subsequent license renewal.

We believe that the rule considerations in the SECY are not significant, but could produce significant improvements and efficiencies in licensing and implementation, and provide for clear demonstration for reasonable assurance.

We believe that adequate aging management of technical issues by the industry is critical to enable acceptable understanding of aging management degradation mechanisms and applications for subsequent license renewal.

The staff will continue to review and assess the technical issues, and intends to further engage the committee at a later date when we have gathered additional findings and conclusion based on our research and expert panels. And we will incorporate those as part of the established mechanisms for GALL and our SRP.

The staff believes that the current license renewal safety reviews are adequate and appropriate, and those principals should continue for subsequent license renewal.

They're listed here on the slide again. That is with the possible exceptions of detrimental effects of aging on the functionality of certain plant systems, structures, and components.

The regulatory process is adequate to ensure that the licensing basis for all plants provides and maintains an acceptable level of safety, and that each plant's licensing basis must be maintained during the renewal period, in part through management of age related degradation.

We also believe that a proposed framework by the staff ensures and maintains safety during the period beyond 60 years. And we believe that the principals and processes that we discussed with respect to the regulatory framework are policy matters, and they are currently under consideration by the Commission.

This concludes our presentation for the morning. As I stated at the beginning, our goal was to show you that we performed a comprehensive assessment of the current regulatory and technical framework to support subsequent license renewal.

And from our assessment, we believe we identified the correct focus areas that are needed for the staff to have reasonable assurance that plants can operate safely beyond 60 years.

I've appreciated all the questions and dialogue we've had this morning as part of our discussion. And the staff's available to answer any further questions or address any comments you have.

CHAIRMAN SKILLMAN: John, thank you. Let's pause here for a minute. To my colleagues, might you have any further questions for the team that's before us? On the phone line, is anybody there?

MALE PARTICIPANT: Is it open first? They're screaming at you, supposedly.

CHAIRMAN SKILLMAN: It was supposed to be open. Anybody there?

MALE PARTICIPANT: It's not crackle and pop.

MALE PARTICIPANT: Yes, it was awful quiet for an open line.

MALE PARTICIPANT: It's too quiet to be open, unless nobody's there. But even there you get pops and crackles.

CHAIRMAN SKILLMAN: Good morning, is anybody on the bridge line, please?

MR. LEWIS: I'm on the phone line.

CHAIRMAN SKILLMAN: Oh, good morning. Who are you, please?

MR. LEWIS: My name is Marvin Lewis. I have been hollering at you for the last two minutes. But unhappily, just saying the phone lines are open doesn't mean the phone lines are open.

CHAIRMAN SKILLMAN: Marvin --

MR. LEWIS: But that's exactly my point. Exactly my point. I appreciate the staff and the ACRS going through these very complicated and impressive whatever.

But I asked you, and I ask you now very simply, have you looked into one, a repair tag blocking a warning light, or a romantic triangle causing an accident at Chalk River, or just simple things that might really screw things up?

I appreciate your looking at the more complicated things like stress corrosion, cracks, and what have you. But there's a lot of simple things that just about are never looked at.

For instance, you've just put out a FR, federal register notice on the point where it's marked concerning flags after the leases have asked for 40 years. And it goes into a few other areas that I think are important.

Have you been trying to look into that as an every day process instead of trying to look at it probabilistically, in other words, just through looking at numbers and looking at chances?

Is there a chance that you're going to have blockage of your coolant? Or are you just going to look at it as an esoteric numerical exercise? Over and out.

CHAIRMAN SKILLMAN: Marvin, thank you. Are there any other individuals on the bridge line, please? Hearing none, would you close the bridge line? Are there any members of the public or in the audience that would like to make a comment, please? I see that there are none.

John, Bo, to each of you, thank you very much for your patience with us, for your good presentations for the last three and a half hours. It's been very informative. I thank you. And this portion of the meeting is ended.

(Off microphone comments)

CHAIRMAN SKILLMAN: Ladies and gentlemen, we are moving to a new pair of presenters. And we're inviting Joe Giitter and Jerry Dozier to the table, please. Ladies and gentlemen, we're still in session, we're just changing presentation teams.

We're still in order. And Joe Giitter, welcome. And Jerry Dozier, welcome.

MALE PARTICIPANT: All quiet, please.

CHAIRMAN SKILLMAN: Please, proceed.

MR. GIITTER: Okay thank you, Chairman. At first I would like to thank you for the opportunity to discuss why we believe that subsequent license renewal should be a consideration for rule making for PRA.

With me is Jerry Dozier. Jerry is a senior risk and reliability analyst in the division of risk assessment. But he previously worked in the division of license renewal and brings a lot of experience of license renewal with him.

Before we get started on the presentation, I wanted to emphasize that while the two divisions ultimately couldn't come to a compromise, that I believe both at the management and at the staff level, we've followed the NRC values. And I consider that to be very important.

So with the next slide, just kind of an overview. We believe there are a number of reasons why PRA should be a consideration for subsequent license renewal.

Fundamentally, we believe this is a policy issue. When the SECY paper came to my division for concurrence, and it did that because we are involved in doing the SAMA reviews for license renewal, what surprised me about it is there was absolutely no discussion of substance about PRA.

And I felt, you know, for such a major initiative, that that was inconsistent with the Commission policy statement on the use of PRA.

So that was fundamentally my first concern is for something as major as a regulatory process that would allow plants to operate from 60 to 80 years, to not even mention PRA, I think didn't meet the intent of what the Commission thought about in 1995 when they developed the Commission Policy Statement.

We also believe that the consideration of a PRA requirement for subsequent license renewal is consistent with other regulations. And the one I would note, and I did note in the non-concurrence is the requirement for new reactors to develop and maintain a PRA for initial licensing, and then to upgrade their PRA for license renewal.

Jerry's going to talk about some of the reasons why inclusion of a PRA requirement also makes sense from a safety perspective, including the continued assurance that the safety goals are maintained as plants age beyond 60 years.

I believe it was discussed here earlier, the plant's risk isn't static. It changes as a function of time based on modifications that are made, based on aging of components, both passive and active.

And it's important that PRA's a tool that would allow you in an integrated way to be able to measure that risk profile as a function of time.

And then Jerry's also going to talk about the value of PRA as a tool to focus inspection and maintenance resources on those structure systems and components at greatest risk significance.

And I believe there was some discussion of that as well. We believe PRA, as part of a risk informed decision making process, is a valuable tool to do that.

MEMBER STETKAR: Joe? I apologize if this was covered when I was out of the room. But early on this morning I asked about the staff's experience in the, I have to be careful of the words I use here, let me just say the consistency of the PRAs and the staff's review of the PRAs that are performed to support the SAMA analyses. Was that discussed, or was that --

DR. SHACK: It was mentioned, but it would be interesting to hear, again, from the PRA point --

MEMBER STETKAR: Out of the 73 that you've looked at now --

MR. GIITTER: Yes, Jerry actually does the SAMA reviews, so I'll let him talk about that.

MEMBER STETKAR: Okay.

MR. DOZIER: Well actually, we use PNEL and the Center for Nuclear Waste to support us with the SAMA review.

MEMBER STETKAR: Okay. I'm a consultant, and the client eventually has to answer the questions.

MR. DOZIER: Okay. But it's a bigger question because when we get a SAMA review, we take the best available information. In other words, if they have a fire PRA, they are to use the fire PRA.

In SAMA space, realize we're talking environmental space at this point. We don't say go off and do a fire PRA. We basically have a multiplier within the SAMA to take into account of it.

What we don't ask though is we don't ask them to update any of the information, but to take the best available information.

MEMBER STETKAR: I'm asking in terms of --

MR. DOZIER: The quality of the PRA.

MEMBER STETKAR: -- if you look at the 73 that you've looked at, is there a high degree of consistency in terms of the scope and the quality, or is there a low degree of consistency in the scope and quality. Or can you better qualify it than high or low?

MR. GIITTER: I would say that because we use the state of the art, as Jerry had indicated. I will answer that question more generally and not just in terms of SAMA reviews.

MEMBER STETKAR: Okay.

MR. GIITTER: But I would say that the quality of PRAs does vary within industry. And you know, I can say that based on our experience with doing risk informed license reviews.

Now for things like NFPA805, there is a quality standard, you know, that has to be met. Certainly Reg Guide 01-200 now has to be met. But I would say that there is a variation in quality within industry in PRA.

MEMBER STETKAR: And just to be clear, I don't like the term state of the art because I don't understand what it means. By state of the art you meant the state of whatever you're given because the state of the art, actually --

MR. GIITTER: Is not the state of the art.

MEMBER STETKAR: -- is state of the art, people know how to do fire PRA, flooding PRA, seismic PRA --

MR. GIITTER: Yes.

MEMBER STETKAR: -- and Level 2 PRA and shutdown PRA. So the state of the art is indeed a full scope Level 1, Level 2, all hazards PRA. That's what I would consider state of the art.

State of what you're given is what you're given. And what I'm asking you about is the variability in what you're given.

MR. GIITTER: Yes. And I would say, and we have people in here that I could get to chime in. But I think there is some variability. Steve? Is Steve Dinsmore here?

Maybe Steve could comment quickly because Steve does a lot of the risk informed licensing reviews and he could probably comment on that better than I can.

MR. DINSMORE: Yes, hi. My name's Steve Dinsmore. I'm a reliability and risk analyst in APLA, which is a branch in Joe's division. All I can say is that I agree with him, that there is quite a range.

MEMBER STETKAR: Okay.

MR. DINSMORE: It goes from, they seem to meet half of the ASME standards at Category 2 to they meet almost none of them. But they're slowly improving. It's a little hard to tell what's going on out there. But there is a wide range.

DR. SHACK: But in terms of scope, Steve, I think I've really only seen one where they've actually had an internal events, seismic, and fire. Most of the time, you're sort of making up the seismic and fire with a multiplier.

MEMBER STETKAR: And they're internal events at full power.

DR. SHACK: Internal events at full power.

MR. GIITTER: Right. And right now there's no low power standard in place. So until that's in place, even the new reactors don't have to have --

DR. SHACK: So they're consistent in the sense that the scope is generally pretty restrictive.

MR. GIITTER: Yes. And I would say in general, there's been some improvement, you know, with NFPA 805. About half of the plants have fire PRAs. Fleet wide, Exelon for example, is doing fire PRAs because they want to take advantage of risk informed tech spec 4B.

And of course with site, you know, Fukushima NTTF 2.1 will result in additional seismic PRAs. But it's in a state of flux.

MEMBER STETKAR: But that's today.

MR. GIITTER: That's today.

MEMBER STETKAR: Seventy three licenses have been renewed already. And the SAMA analyses have been reviewed for those 73.

MR. GIITTER: Right, yes. When you're doing a SAMA review, it's not as complete as a Level 2 PRA. It's a, you know, it falls short of that.

MR. DOZIER: It's not a risk informed submittal.

MEMBER STETKAR: It's not a risk informed submittal, but they rely pretty doggone heavily on the PRA and the risk --

(Simultaneous speaking,)

MR. DOZIER: Oh, absolutely.

MEMBER STETKAR: -- report, so --

MR. DOZIER: What I'm saying is they don't have to meet the standard and things like this. It's when we talk about the -- oh, I'm sorry.

MEMBER STETKAR: I understand the legal nuances of risk informed. What I'm asking is in the current license renewal process, people do use PRAs to quite an extent.

And those PRAs, at least from what we've seen, are quite variable to justify one part of the license renewal. Happens to be parked over in the environmental review area, but it's indeed one part of the license renewal process.

And I'm trying to get a reading from the staff in terms of the variability and the quality of the PRAs that are used for that, and the level of detail that the staff applies to look at those PRAs because they are used to make decisions.

MR. DOZIER: Right.

MEMBER STETKAR: Or they're used to justify no decisions, usually.

MR. DOZIER: Yes, sir. And the last slide we have actually goes into the SAMA. And I'll explain kind of that process that we use and how we do that. Yes, sir.

MR. GIITTER: So as I was saying, when the SECY paper came to us for concurrence, there was no discussion of substance on PRA and the role it might play in a rule making for subsequent license renewal.

And of course, the PRA policy statement says that the use of PRA should be increased in all regulatory matters to the extent supported by the state of the art.

And you know, I just wanted to point out briefly that when the Part 54 rule making originally was issued in 94, the PRA policy statement was still under development.

But it did acknowledge in the Statement of Considerations for Part 54 that PRA methods would be useful on a plant specific basis to assess the importance of SSE subject to AG management.

And I'll also note that the PRA policy statement used the term supported by the state of the art. And the state of the art of PRA has advanced considerably in 20 years.

So based on that, the conclusion was that, I believed anyway, that not really discussing PRA at all was an oversight in terms of the SECY paper. I felt it should have addressed that.

We also believe that the regulatory framework that would provide a technical basis for allowing reactors to operate for up to 80 years should at least consider risk. And so we were bothered by that.

We set up a number of meetings, both at the staff and the management level with the Division of License Renewal. And we were actually close to coming up with some compromise language that credited the use of risk assessment to measure the effectiveness of an aging management program.

But ultimately that was rejected. The compromise language was rejected because it was believed by the license renewal folks that it wasn't uniquely relevant to subsequent license renewal.

Next slide. So instead of looking back 20 years to the time frame when the Part 54 rule was promulgated, what I'm really proposing is that we try to imagine what the future is 25 years from now.

Without any additional requirements for PRA, you could have a situation where passive reactors, say AP 1,000s or SMRs, have updated, high quality PRAs that are effectively used to manage risk.

In contrast, there would be reactors operating alongside that are operating for 60 plus years with outdated PRAs that may not necessarily reflect the risk of the plant.

And so fundamentally, does this make sense from a policy perspective when we know that the baseline risk for passive designs may be as much as two orders of magnitude lower than for operating reactors.

CHAIRMAN SKILLMAN: Is that first carrot really 50.71 or 52.71?

MR. GIITTER: It's actually 50.71.

CHAIRMAN SKILLMAN: It's 50.71?

MR. GIITTER: Yes, it's --

(Simultaneous speaking,)

MR. GIITTER: Don't ask me why. I can't give you the background. But it is --

(Simultaneous speaking,)

CHAIRMAN SKILLMAN: It's bizarre. That's the only place you can find it.

MR. GIITTER: It's a good check, okay.

CHAIRMAN SKILLMAN: It's interesting because it's pointing to a coal for what is a Part 52 license. Thank you. Okay.

MR. GIITTER: So I'm going to turn it over to Jerry at this point and he's going to talk about some of the technical rationale for why we believe that subsequent license renewal should consider PRA in the rule making effort.

MR. DOZIER: Good morning. This goes back to Dr. Stetkar's question that he asked during the license renewal portion. But before I get into this segment, I would like to talk about what happened with our risk informed initiatives in maintenance.

For example, the 1980's, basically what we had at that time was fixed frequency tasks done at standard intervals. And we had corrective maintenance. That's basically all we had.

When the early '90s came around, reliability centered maintenance started emerging, PRAs after the '88 time frame started becoming available and we got the PRA policy statement, then we got the maintenance rule. And this was after the license renewal rule in '95.

This was the first risk informed, performance based rule in 1996. Okay, so what happened to our maintenance? And if you look at what really happened, in maintenance rule, we were looking for performance.

We wanted the system to be available. We wanted the system to have not too much, have little corrective maintenance. And so we monitored those, and we called it monitoring the effectiveness of maintenance at nuclear power plants.

So from that, industry started doing smarter risk informed maintenance. Instead of going out and overhauling a pump at a fixed frequency that the time or the calendar told you to do it, we use predictive technologies, predictive technologies to tell us, like LUVOL analysis, vibration analysis to tell us when the pump really needed to be done.

So then that was the important thing. This was predictive because it was risk informed. Also, we were considering what we took out of service, you know, how it affected the overall risk.

So we had, you know, on one side license renewal which was deterministic and still primarily is, to a risk informed strategy. So that kind of sets the framework for some of the differences that we'll be talking about here.

For example in this slide, the scope and consistency. Well basically, you know, for most of the initiatives that we've done so far like maintenance rule, we use a scoping that was risk informed.

Let's work on the important structures, systems, and components, and then things were low. Okay, now these were license renewal. And as they're adding, and one of the options they want to add, you know, other deterministic criteria to build on the scoping.

And license renewal is basically, and this is why we wanted an updated PRA, is so that we can look at all the changes to see what's important now. And so we believe that an updated, plant specific PRA could potentially identify vulnerabilities beyond the limited design base.

And I want to give you an example in the next slide. This was a pilot study that South Texas did. Basically, if we look on your right hand side, on the non-safety systems we see that, well let's go to safety systems because that's a little bit surprising.

You have your safety systems and 75 percent of them that were deterministically determined was really low safety significant, and only 25 percent were really highly safety significant.

Now on the other hand, what could we be missing? Well it identified that for non-safety systems, there's about one percent of those that could be safety significant. And so this was what the other side of the house was doing that was risk informed.

Surveillance and inspection. For inspection, also in the license renewal we talked about 10 CFR 55, 55A dealing with codes and standards, ASME codes and standards. What did they do?

Basically, they became, you know, there was a new code case that actually risk informed. So what did risk informed ISI do? Risk informed ISI accounted for the risk significance from the PRA, and it also looked to the level of the susceptibility of degradation.

It went to the level of mechanisms. For example, stress, corrosion, cracking, that type of level, the mechanism level. So in here, now of course, PRA is a two edge sword, so a lot of deterministic people don't like to talk about PRA in that manner because we did focus resources in one area, and we did resources in the areas where there was very low susceptibility of that corrosion type, or they were unimportant.

Design input parameters. One of the options was to look to see if there was any design input parameters that we may look at. Well again, the PRA and an updated PRA can show you which design inputs are most important.

And sometimes those are kind of hard to identify from a deterministic method. One example is where that passive seals, basically, in an area could degrade and you could have internal flooding that affects the safety related components.

And it's hard to see that from a deterministic viewpoint. But the PRA can help us to identify those types of vulnerabilities.

MR. GIITTER: Yes. Just as an example, there was a PRA that was done back in the late '70s, early '80s that identified seal failures that resulted in turban building flooding and the plant in question had switch gear in the turban building. It was very high risk significance.

And so, you know, as Jerry indicated, those are the kind of things that if you model properly in a PRA, you can find vulnerabilities you might not otherwise find.

Now we did, and I've got Sunil Wernkkody here. We've had a record number of STPs resulting in greater than green findings based on NTTF 2.3 walkdowns where they found, you know, seals that weren't in place, missing at a number of plants.

Sunil, how many? Probably close to a dozen or so, something like that. Anyway, you know, it is a real phenomenon. And if you do the PRA right, you model it right, you can find vulnerabilities that you won't necessarily find taking a purely deterministic Chapter 15 accident analysis approach.

CHAIRMAN SKILLMAN: Joe, let me ask this. And I ask this without prejudice, just as an engineer and a 47 year nuke. I get it on your PRA discussion. I really do. I watched the industry change with the maintenance rule.

In my view, that was a single lightning bolt. That combined with the thick magnifying glass of INPO and the change from SELP to the current inspection basis, for changing how the plant health fundamentally changed. And I mean that for almost all the plants in the country.

That was, in my view, significant. The PRA approach helped that. I'm talking '90, '91 through about '96, '97. And so I'm a believer in your argument. My problem is connecting your argument to SLR.

So I am fully supportive of what you are communicating. But making this a component of SLR seems, to me, to not yet have the linkage that I think needs to be there. So that's what I would like to hear explained.

MR. GIITTER: Okay. I actually have that in a later slide. I can talk about it now if you like, or I can --

CHAIRMAN SKILLMAN: No, let's move on. We've got people from across the country. I would like to break by five minutes to 1:00 so we stay on our schedule.

MR. GIITTER: Sure.

CHAIRMAN SKILLMAN: Thank you.

MR. DOZIER: Okay, again on some of the risk informed initiatives. Of course our reactor oversight process is risk informed. So we have ways to measure effectiveness.

And I'm on the wrong slide. Option 4 that was mentioned discusses how the staff wanted to seek assurance that changes over time to cite parameters that may effect the CLB are understood.

Well, we have a region component design basis inspection verifies this. And then one of the first things that they do when they do that is they go and they look at PRA to identify the most important areas. So here again is where an updated PRA can help us in so many areas of our regulation.

And actually, you mentioned IMPO. And actually Dr. Shack, this question about do we have reporting of passive and active components within the maintenance rule, and yes we do.

I was also in the operating experience group. And October 17th of 2007, I did do a presentation to our executive team that looked at the EPIX database, passive and active components. And it did provide a lot of insights.

And so again, that was something because we let the industry go and we've made them be accountable for availability and reliability, but we let them do it in the manner that they wanted to do it, they went out as an industry to form this EPIX database that Dr. Shack mentioned earlier to provide that.

And that's what they do in maintenance rule now is they provide us with our higher level reportability requirements and our daily event reports, and also our licensee event reports.

The smaller level functional failures or maintenance preventable functional failures that they have, they report to IMPO. IMPO provides documents summarizing the lessons learned from that information. That was a little side note to, I'm sorry, to answer your question that you asked earlier.

Internationally, what's happening internationally, and also within our own division of our Office of Research? There's been a lot of things. Actually, just two weeks ago the Canadian regulators gave a workshop of what they were doing with aging and their PRA.

Our Office of Research also has done work. If you need a list, I have a list of papers that have been generated. But I do want to mention one, and it was new reg CR 5632 which was incorporating aging effects and a PRA, a feasibility study utilizing reliability physics models, it was published in 2001.

And a co-author on this new reg was Commissioner George Apostolakis. So the international community, our own research has looked into what happens when a plant ages.

And you asked the question, well what's the magic thing that happens in 60 years? What is that? Well we hope that the current licensing basis will keep our failure rate at a constant rate as assumed in the PRA.

A common denominator of these aging PRA studies is basically, you know, as the bathtub curb goes up, your failure rate increases. What these PRAs primarily do is they look and see what this effect.

So these PRAs gives us, again, predictions of what we might could occur in the extended period. So is it magically anything happened? Well we want to use the PRA in an upgraded fashion to see what those vulnerabilities and sensitivities might be.

And we think that's even more important as we get beyond 60 years and get that wear out portion of the reliability curve.

MR. GIITTER: Is the next slide mine?

MR. DOZIER: No.

MR. GIITTER: Oh, yes SAM. Okay, go ahead.

MR. DOZIER: Okay, the next slide, as promised, is the Severe Accident Mitigation analysis. If I could just briefly describe what that process is. Basically, the SAM analysis is a simplified Level 3 consequence analysis.

It's over in the environmental report because he's talking about the environmental effects of this. Although it kind of has a safety feature. It certainly does. It certainly has.

But it's performed to meet our NEPO requirements. Okay what the SAMA does, it identifies plant specific potential cost beneficial changes that can reduce the plant risk.

Most potentially cost beneficial SAMAs identify the analysis or procedure changes, training or minor design changes such as having a backup portable generator or small things like that.

Major design changes typically are not cost effective. Several plants have identified anywhere from one to 11 potentially cost beneficial SAMAs during the license renewal review.

Now of those cost beneficial items that they have, if they're not age related, we don't put them into, you know, the licensee don't make a commitment to go do them.

They have an incentive to do it because it reduces their risk number. And if they come in later for a risk informed initiative, they want to have their

CDF low.

So there's incentive for them, a voluntary incentive for them to do those. But we do not require that. And if we do want to require them, we have to do go through the backfit process.

Now the license renewal or subsequent license renewal. What's the big difference that we'll have from 60 to 80? Okay, right now, and of course this I'm talking a Part 51 requirement, not 54, so I'm a little out of context, but this is still license renewal.

Basically, in subsequent license renewal, if they've already performed a SAMA one time, they don't have to do it again. That's in Part 51. Now it'll continue, and basically what I'm saying here is subsequent license renewal, DRA will be out of the picture as we stand right now.

But let's say we ask for this upgraded PRA, just like we did in generic letter 8820 with the high PE, IPEEE. Most of these cost beneficial things really come from the Level 1, Level 2, and the flooding, external event's PRAs.

We can still look at the importance measures to find how changes to the plant could benefit the risk.

So we could still gain those benefits from an updated PRA.

MR. GIITTER: Okay. Chairman, I wanted to answer your questions. And I want to make sure, there is a number of reasons why I think subsequent license renewal is the time to consider this. I'll talk about some of the policy reasons.

But there's also, I think, technical reasons as well and I want to talk a little bit about that. And as we had indicated earlier, we already have the capability, in fact just about every plant operating in the United States has risk informed in-service inspection.

So we're already using PRA techniques to determine which, to do smart inspections of those passive components of greatest risk. So we already know how to do that.

And there is a lot of effort underway right now to be able to incorporate models that look at passive component aging into PRA. And certainly, I think by the time that the plants are looking at actually going into operation for greater than 60 years, I think many of those methods will be mature.

But a lot of that work's going on outside the

United States, as Jerry indicated.

MEMBER BLEY: Before you go forward, John, that's kind of the piece that I'm glad you're mentioning because everything else that I've read, and I don't think I got that in reading your paper, everything else I read was pretty much bringing plants licensed under Part 50 into kind of PRA state of the art with the newer plants.

But the idea that you can treat some of this passive equipment and structures probabilistically within the PRA seems to me the thing that might become very important.

And in fact, that's what the expert panels are kind of doing. And you haven't emphasized that until right here at the end.

MR. GIITTER: In the non-concurrence. And I have to say, I wrote the non-concurrence on a Saturday afternoon in between trips. So you know, it wasn't a lot of effort on my part.

But I did mention risk informed ISI. And I think that serves as, it's kind of a model for how we could do this, you know, for subsequent license renewal.

MEMBER RICCARDELLA: You know, I'm not by any means a PRA expert, but I've been heavily involved in the implementations of risk informed ISI and associated ASME code rules.

And really, the majority of that work did not consider a formal PRA in any sense at all. I mean, all we did was look at components to say what are high risk, what are medium risk, what are low risk, and then look at susceptibility, what are high risk, what are medium risk, what are low risk. And we ranked them and picked our inspections based on that.

And I think my understanding is the reason for that was that when you look at a PRA, its passive components really never turn out to be a significant contributor to the risk in a PRA. Correct me if I'm wrong, some of you PRA guys.

MEMBER BLEY: Only because we haven't been looking at long period of times where they might become.

MEMBER RICCARDELLA: Right.

MEMBER STETKAR: The argument has been that --

MEMBER BLEY: In the short term --

MEMBER STETKAR: The short term, they're not.

MEMBER BLEY: -- the state is everything

else.

MEMBER RICCARDELLA: Yes, but because of that, my understanding is that most PRAs give very, very crude treatment to those types of --

MEMBER STETKAR: Most PRAs give essentially no treatment. Not crude.

MEMBER RICCARDELLA: Yes, they just make some assumptions. You know, and so I don't think there's anything going forward in this subsequent license renewal that keeps us from risk informing the process the way we did with risk informed ISI.

But that doesn't necessarily require a full blown PRA or an update to a PRA.

MR. GIITTER: Yes, well let me talk about some of the reasons why I think subsequent license renewal is probably the right place to do this. But to answer your question, the techniques, you know, there's still a lot of work to be done.

But I think that you can model passive systems. In fact, I would argue that for new reactors, they rely on passive systems for safety. So you know, it's certainly something you can consider in the risk model.

But as Jerry indicated, you know, there's a land to tile approximation unavailability, right? The failure rate times the mean time to repair. And that assumption is that failure rate is constant, right?

Well we know from experience from some of these age related degradation mechanisms we've talked about, whether they be thermal fatigue, high cycle fatigue, primary water stress corrosion cracking, that things can change.

And you know, as we get a better understanding of those, I think we'll be in a much better position to be able to, and operational experience, we'll be in a much better position to be able to model that in a risk assessment.

And moving forward, I think we'll be in a much better place to be able to characterize and understand the risk in a way that we may not be able to otherwise. But going back to why subsequent license renewal, first off, the PRA quality as you indicated John, it's not consistent right now within industry.

Where we have seen improvements in quality, it's been driven by voluntary initiatives, things like NFP 805, to a lesser extent 5069, risk informed tech spec 4B, you know, things where utility sees a benefit in upgrading their PRA.

Without additional incentives, will licensees voluntarily update and maintain their PRAs? I'm not sure. But a PRA requirement at the subsequent license renewal is one way of ensuring that.

The response to the non-concurrence cited effort's under way. And I heard some of those discussed today in support of the Near Term Task Force Recommendation 1 and the risk management regulatory framework as a potential means of addressing a PRA requirement for operating reactors.

I have staff in my division that are supporting this effort, and I can tell you that I'm not confident this is going to be a case.

In fact, the working group on the Near Term Task Force Recommendation 1 did look at an approach modeled after the approach recommended by the Risk Management Task Force that required licensees to develop plan specific PRAs.

And based on the cost estimates developed by the staff and industry, it was concluded that the cost to existing Part 50 licensees was greater that the safety benefit. And that's part of because of the way we do cost benefit analysis.

But nonetheless, it was a situation that wouldn't pass the backfit rule. The bottom line is that rule making for subsequent license renewal provides that unique opportunity for the staff to explore the option of a PRA requirement.

And that was really my intent. It wasn't saying there absolutely has to be a PRA requirement. It's just this should be a consideration for the Commission to think about.

Yes, there are potential opportunities to require PRA outside of subsequent license renewal. But to use OGC phraseology, at least in my opinion, they're remote and speculative.

DR. SHACK: You think they won't raise the backfit argument if you put it in SLR?

MR. GIITTER: You don't have to do a backfit.

DR. SHACK: Pass a new rule, you probably will.

MR. LUBINSKI: John Lubinski, and I'm going to ask, I think we do have OGC in the room today. But if you look at the backfit criteria that we're talking about in current Part 50, it's different than what you're doing from the standpoint of a rule making.

You do have to do a cost benefit analysis as part of that. And you can make a determination that you would still go forward even if it would not pass the cost benefit analysis. It's a little different standard along the way.

DR. SHACK: But you don't have to do a 5109 backfit analysis.

MR. GIITTER: So anyway, to kind of summarize, I appreciate the opportunity to express our views. And we believe that our proposal leverages risk insights based on plant specific risk profiles and our best understanding of age related phenomenon to help ensure that we make the best decisions about the future.

And the process laid out in the SECY relies on a deterministic, process driven approach for aging management that was established 20 years ago.

One final thought. In exploring the use of PRA in subsequent license renewal, I believe it would be important for us to look at resource benefits and using risk insights to focus resources on aspects of an aging management program of greatest risk significance.

Right now under the current concept of an aging management program, all age related structures, systems, and components are equally important. Really, what we're proposing here would result in a potential cost savings to the NRC and to the industry, and result in greater reduction of risk associated with aging components.

So should a PRA be a consideration for subsequent license renewal? Is it relevant at subsequent license renewal? I believe it is, absolutely. That concludes my remarks.

CHAIRMAN SKILLMAN: Joe, thank you. Let's take a pause here. To the members, any questions you would like to ask or any further clarification you might wish to have?

Joe and Jerry, thank you. Would you please make sure the bridge line's open?

(Off microphone comments)

CHAIRMAN SKILLMAN: Ladies and gentlemen, I want to make sure the bridge line is open to see if we have comments, and then we'll go to the audience as soon as we're done with that portion of our meeting.

Is there anybody on the bridge line, please? I ask again, anybody on the bridge line?

MR. LEWIS: No comment at this time.

CHAIRMAN SKILLMAN: Marvin, thank you, understand. Anybody else? Ladies and gentlemen of the audience, are there any comments, please?

MR. WERNKKODY: My name is Sunil Wernkkody. I'm the Chief of the PRL Operations in the Human Factors Branch in the regional risk assessment. One of my primary responsibilities is to support the reactor site process, primarily to relieve any findings that the regions consider as potentially significant.

What I want to do is make a couple of statements. You know, Joe mentioned with respect to some of the findings, with respect to flooding and how they may relate to this particular issue.

Last year, just to give you the context how inspectors in a given year find maybe thousand inspection findings, thousands. But a very small fraction of that comes to us for the licensees.

And under the licensees our regional analyst conclude that they may be potentially significant. During the last year, because of the Fukushima related efforts, there was a significant focus on looking at flooding and seismic kind of issues.

And majority of our findings were with respect to flooding. And one of the things that Joe alluded to, and I can make a statement here, and if the Committee decides to follow up with factual information, was majority of them were related to flood related.

And more importantly, they were related to the passive components in that these issues became potentially significant and ended up being, number of them, either yellow or white, which is ended up being finally significant primarily because some of the passive components the licensee relied on did not, either failed to work or did not work properly.

This included sometimes things like the dams they plan to build, and sometimes this depend on some of the seals that they were relying on for flat protection.

Now, I am not expert like Jerry is on license renewal. But I do know that with respect to passive barriers, at the present time, these are not things that we necessarily pay a lot of attention to.

In my professional opinion, in an effort for subsequent license renewal, it's good for the agency to pay more attention on a going forward basis to such components.

Now how we do that, whether we're using PRA or otherwise, it's yet to be remain. But I firmly believe that it's good for the Commission to consider PRA as one of the options, because in my view it primarily enhances safety.

The second point I want to make is actually not based on my experience as a regulator, but going back to like 25 years ago when I was the supervisor at the facilities overseeing the operations at four plants.

For a while there, I was in charge of monitoring how we address the risk informed ISI. It's been, like, 25, 30 years ago, but I still remember when we did the initial efforts to come out and find out that we were testing certain very reliable components that don't age.

For example, the RCS pipes to death, you know, we found that we were testing them so frequently but never finding any problems with them. But at the same time not testing some of the key passive features such as service sewer pipes which are prone to degradation.

So at that point in time, I realized as a licensee how great it is if we could focus our resources to more risk significant components.

Now I can't, and I shouldn't speak for the licensees right now because it's been, like, 15 years I became a regulator, but at that time I realized that in any area that we been in risk informed thinking, it helps us be more in pro-safety and at the same time, reduce some of the unnecessary burdens. Thank you.

CHAIRMAN SKILLMAN: Thank you. Are there any other comments from the audience, please? Hearing none, we will break until 1400, 2:00 p.m. on that clock.

(Whereupon, the foregoing matter went off the record at 12:46 p.m. and went back on the record at 1:59 p.m.)

CHAIRMAN SKILLMAN: The meeting will now come to order. It is 2:00 p.m., 1400. And we will begin by hearing from Jason Remer from NEI. Jason, you got the floor.

MR. REMER: Thank you very much.

CHAIRMAN SKILLMAN: Yes, sir.

MR. REMER: I appreciate the time to come and speak with this body about subsequent license renewal. It's an issue that we've been very interested in over the last few years. To introduce myself, I worked at Arkansas Nuclear 1 for 18 years in the power plant. And probably should have stayed there. Rural Arkansas is pretty nice, pretty cheap, a pretty nice life.

MEMBER STETKAR: Hot springs.

MR. REMER: Yes, hot springs are nice.

Where two thirds of the vehicles are pickup trucks. You know, it's hard to find a sedan down there near the plant. But kind of motivated me to become interested in this topic. Because it really does deal with what's going on where our plants are located.

So as far as an outline, what I want to cover this afternoon, factors supporting long term operation. The fact that we're , SLR is built on a successful license renewal program. How we're preparing for long term operations in SLR. And let's look at the aging management process a little bit.

I would like to go point by point on the SECY paper, and then provide a summary. You're going to see a couple of slides, and a couple of documents that you've seen before two or three times. So I'm going to take that to mean that it's probably on the mark.

So why are we here today? Well, we're here because nuclear generates a substantial portion of our electricity. And an even more substantial portion of our emissions free electricity. We expect that to continue. Sixty-one percent of the emissions free electricity is provided by nuclear.

I know you know that already. But electricity demand, even though it's slower than expected about ten years ago, it still is increasing by two percent a year. We've got a good news story with our nuclear facilities.

Even with a couple of big outages, and the fact that we had San Onofre 2 and 3 down, we still had a 90.9 percent availability factor in 2013. If you take those two out, you're at 92 percent. That's an all time high as far as reliability and productivity.

When you compare that a little bit with, coal is 55, gas 56, hydro 42, wind 31 and solar 27. So 92 percent looks pretty good. That's 24 hour, seven days a week, 365 days a year and Christmas, you have nuclear power electricity.

I like to tell my kids, and I live in Virginia, you know, to look at the lights. And, you know, four out of those ten lights are powered by nuclear electricity. A lot of kids in grade school, you know, they think it's all from solar. No, it's a lot from nuclear. And some states more than others.

DR. SHACK: Come to Chicago.

MR. REMER: Yes. I don't know what the number for Chicago is.

DR. SHACK: Four out of five.

MR. REMER: Four out of five? Yes, I know it's big, big time. So, availability is good, productivity is good. Accident rate. Again, you know, if you're at a nuclear plant and you're having industrial accidents, it's hard to spin for the regulators and say, we're operating safely. You know, we're taking care of the core.

But, you know, people are getting killed, and they're getting hurt at our plants. And the few unfortunate events that do occur where you have fatalities are very unfortunate. But overall, nuclear rates right up there, I think with insurance offices. Very safe place to work.

Here's a little graph that we just updated recently. You've probably seen the one with 40 years of operation, and then 60 years of operation. What I had our staff do is update this, showing with this line here, if 80 percent of the existing plants go to 80 years, here's what you have. You best have the area under the curve there. If all of them go to 80 years you're talking about this green line here.

So, as you can see there, compared with all the previous nuclear generated electricity, with SLR you're talking about a very substantial amount of megawatt hours on the grid, safely, effectively, environmentally sensitively. That doesn't come without a price though.

We do spend a lot of money on our nuclear power plants. We invest heavily in various areas. Updates, and extended operation has been a big one in 2012. This shows the spinning by year. Overall in 2012 we spent as an industry 8.5 billion dollars in these areas. Fifty-one percent of it, upgrades, license renewal, making things better, better for the future. A lot of equipment replacements.

People think, okay, these are old plants. These are 50 year old plants. Well, they're really not. They're, the structure's there. Many things are that old. But many of the moving parts and the equipment, pumps, motors, valves, control systems, they're all new. And many of them are new for the second and third time.

And so if you walk, and I know you've been in a power plant. But if you walk in there, you see the electronic control systems for the feed water system. You see the INC upgrades. You see the brand new equipment. You see some old equipment that's been maintained very well though. And so, this comes because we spend a lot of money on capital expenses, as well as O&M.

CHAIRMAN SKILLMAN: Would you go back to the previous slide?

MR. REMER: Yes.

CHAIRMAN SKILLMAN: Back one more? In the red, blue and green lines, should we assume that you used the same capacity factors and outage rates as are represented by the present purple line?

MR. REMER: I believe so. Yes, I believe that to be accurate. We used the same availability lines, or assumptions.

CHAIRMAN SKILLMAN: Thank you.

MR. REMER: And certainly if you had other plants drop down, and you lose plants, the line would reduce.

CHAIRMAN SKILLMAN: Okay. So --

MR. REMER: And that's assuming improvements.

CHAIRMAN SKILLMAN: Okay. And so does that line include both San Onofre 2 and 3, and the Calhoun?

MR. REMER: Right now this includes everybody that has renewed licenses. And that would also probably include, and I have to check the data, those that have been shut down. And so I'm not sure about that. That might shift it slightly.

CHAIRMAN SKILLMAN: Okay. Thank you.

MR. REMER: Sure. Okay. That's in the long term. Of course it's not, if you lived in a small town like I did, in Russelville, Arkansas, what happens at the nuclear happens in the community, in the county, Polk County, you know. You know somebody that works at the power plant.

So when you have outages, that you increase the output of the plants, putting in power upgrades, extended power upgrades. You do maintenance. You do large outages. It pumps a lot of money into the local communities. People that live around nuclear plants are proud of their nuclear plant. They're not afraid of it.

I used to tell people at church, you know, hey, a bad storm comes, I want to go toward the plant. That's where I want to be. Because I know it's designed for those scenarios. So it affects, what we're talking about today affects many, many people in the communities the plants are sited.

Of course, emissions, you can see there, and you know this already. Nuclear, as far as life cycle emissions is right down there with hydro, geothermal, wind, solar, et cetera. So very, very low emissions.

If people think they can just replace the nuclear power with something like natural gas, you can immediately see we will increase the greenhouse gas emissions. And we will not meet the current President's requirements or desires for reduction. So nuclear has to play a big part if we're going to do this.

As far as people liking the idea of license renewal, you can see here, and this has just been updated last month, 82 percent of folks that were surveyed agree that we should renew nuclear power plants as long as they continue to meet federal safety standards. I couldn't say it better myself.

We have to continue to operate them safely. An unsafe plant, or a plant that's not operating well is not a plant that we want to be a part of. So, in summary, to give you -- I guess this is a little commercial maybe. Nuclear makes sense. We should consider it.

And it really, as I was thinking about this, it matters in generations. I mean, that's what we're talking about here. I started at Arkansas Nuclear 1 in 1982. And I really fully expected to begin helping close down Unit 1. But that didn't happen.

Unit 1 got a license renewal. It's still operating today. And so is Arkansas Nuclear 1, Unit 2. And so it provides all these benefits to our nation and our local community.

Let's talk about license renewal. So we wouldn't be here audibly talking about subsequent renewal if we didn't have a very successful license renewal program. And I do commend the staff, John and his folks. They have done a fantastic job through the years of working this process, making it efficient, making it work, making it where we could interact with it on a reasonable basis for the most part.

There are exceptions. I'm mostly talking about things that happen outside of their control. And so, Atomic Energy Act anticipated and allowed for license renewal, so does Part 54 and Part 51. They both, right now, today, someone can turn in a subsequent renewal application.

There's nothing limiting to do that. You can turn it in, and it would be completely according to Part 54 today. We're not doing that yet. We want to work together and get us ready for that. But as far as the rule goes, it allows it today. The last 40 or more years, or 40 operating years, and then an additional 20 at a time.

Aging Management, we're going to be talking about that a little bit more. Two main areas of reviews. And you've heard this already, and you know this, because you see everything, safety and environmental.

And the public, a big point here. The public is offered an opportunity to request a hearing. Some of our plants in the various areas, there are really no public hearings, because everybody's really supportive. Others require a substantial amount of work in this hearing area. You've seen this before, so I'm not going to dwell on it.

These, we completely agree with the staff, these are the foundational principles by which we do license renewal, whether you call it subsequent or something after that. Existing design basis is required to be maintained in the same manner and same way as you did in the first licensing term.

This is very important. And it really, it says a lot. It's like, kind of like licensing poetry. It sums up a lot of information in these two principles. And we maintain these principles. And we totally agree with the staff that we want to continue to maintain these principles. I won't dwell on this.

This is just showing that the process by which we go through, it's a well developed process. It's been well tested, 73 applications have been approved, and more are on the way. It's a process we understand. It's a process we've worked with a long time.

Here's a, diving down into one of the elements of the integrated plant assessment, I want to draw your attention to this one item here about, is the component or system managed by existing activities? If it's no, then you modify or add a new program, a new AMP, a new Aging Management Program.

If you have an Aging Management Program that already exists, they you got to demonstrate that the effects of aging are adequately managed. That's the whole engine that drives this license renewal thing.

If you don't have Aging Management Programs that are effective, license renewal doesn't work. And so that's one of the main points I just want to get across here.

The process, and again, you know this. It's a long and expensive process to go forward with license renewal. That's why we want to make sure that whatever we come up with for subsequent renewal is predictable, and is understood. This process didn't just start in a day. We've been working on this thing for multiple, I don't know, 15 years or so.

And through the course of time we've gotten standards and guidelines and processes, throughout the industry and the NRC, that work well to make sure that when we turn an application in it represents the plant. All right. It's very costly. And this doesn't include any type of plant upgrades that you might want to do.

Another thing I'll say here, and I might say it later, is that when you have subsequent renewal and you have another 20 years of operation, you might be able to invest in some new equipment that you wouldn't be able to justify otherwise.

In other words, maybe you want a new turbine, but you've only got five years on the operating license. If you've got 25 years, then you can say, okay, I got 25 years. I'm going to get a new turbine. I'm going to get a new motion separator re-heater. I'm going to replace the feedwater system.

Because you've got plenty of time to stretch out those payments. And so, you actually have an increase of availability and safety in some ways, by looking at subsequent renewal. Because you have a longer term stretch of time to spread these costs over.

History of license renewal. We've talked about this a little bit already. As you can see here, we started back in '92. We got a real, it needed some adjustments. So we revised it in '95. And then we issued, working with NRC, the GALL Report. It's a lessons learned report. It's a compilation, if you will, of things that we learned through the process.

That report has served us extremely well, and it really forms the backbone for our Aging Management Programs. We're up to GALL Rev. 2. And as you heard this morning from Bennett, we're working on the SLR GALL. And we'll continue rolling those things.

So here we are, thinking about, we've already said we intend to submit an application. Industry has indicated that already. So we will have one or more plants that we'll be submitting the application. Hopefully, we'll be announcing that, probably in early 2015, who the plants are. And we would like to submit the application around 2018.

This next slide is really busy. That's for good reason. Just to show you all the things that, all the guideline documents, all the guides that have been issued and are being revised to guide and help us in this process. So a major change to this license renewal process.

I really would request to go back through a lot of the things that we've already gone through, and we've already become mature in our understanding and usage of them. Many of these processes are integrated into our systems, which we use to fill out our applications.

CHAIRMAN SKILLMAN: Jason, please go back --

MR. REMER: Yes.

CHAIRMAN SKILLMAN: -- one slide more.

MR. REMER: Okay.

CHAIRMAN SKILLMAN: You mentioned, in early 2015 you might identify the SLR candidates.

MR. REMER: Yes.

MR. KRAFT: You used four.

MR. REMER: Yes. It will possibly be more than one. Likely to be more than one plant. We went in the first time with two plants, Oconee and Calvert. And so it's likely that we'll have at least two plants. There's a possibility that we might have three. But we definitely got one, and probably two.

CHAIRMAN SKILLMAN: So what you're saying is, this is not a drill.

MR. REMER: No. We're going to do this. People, for the industry and the utility to get far enough along to say they're going to do this, they've already done all their due diligence. I'm aware of two or three detailed economic studies that have gone through to ask the question, does this make sense economically to do?

And the result has come back. If the license renewal process stays kind of about the same as we're doing, as far as cost and time, then this makes good sense. And we're going to do it.

CHAIRMAN SKILLMAN: Explain that if.

MR. REMER: Well, if we decided to get a full scope PRA for every application, and we wanted to go back and do lots of other major changes, way outside of what they're suggesting, this became very uncertain on how long it would take, and how many millions of dollars, then I would think that you would have to pause.

And you would have to ask yourself, does it make sense economically? Because at the end of the day, you have safely operated plants today. And it's a complete economic decision about whether to go forward on SLR or not. You're going to assume, you make the assumption because it's the fact.

The plant will be operated safely, or it's shut down. So you have a safely operated plant. Does it make economic sense to go on another 20 years? And a big piece of that calculus is, what's the process going to be for license renewal.

CHAIRMAN SKILLMAN: Thank you.

MR. REMER: Sure. Okay. Current situation, we've already been over historic times. Twenty-seven plants in the period of extended operation presently. This next graphic just gives you a sense of kind of the age our reactors in bulk.

And a little note here, by the end of this year 38 units will be in the PEO. So that's a very substantial number of plants. Today, we have accumulated about, a little over 40 reactor years of operation in the PEO. In other words, years times reactors. And I want to make a statement about having to operate in that period.

Most of these programs are mature plant programs that we use for Aging Management Programs. They've been in existence since the start of plant operation. And so to say that we have to operate in the PEO some years to get experience is not thinking about what we did back in the PEO today.

MEMBER STETKAR: Jason, let me ask you about that statement.

MR. REMER: Yes.

MEMBER STETKAR: Typically, if we look at license renewals, about a third of the AMPs are characterized as existing. And about maybe 40 to 50 percent are new. And the remaining are plant specific, which are typically new.

MR. REMER: Okay.

MEMBER STETKAR: So when you characterize the Aging Management Programs as things that we've been doing throughout the life of the plant, how does that jive with the statistics on when you look at the license renewals, the number of new programs --

MR. REMER: Yes.

MEMBER STETKAR: -- or plant specific programs that are created? That's --

MR. REMER: I'm not opposed to the numbers. Because you do this for a living.

MEMBER STETKAR: And those are rough numbers.

MR. REMER: Yes.

MEMBER STETKAR: It varies from plant to plant.

MR. REMER: I was thinking more two-thirds and one-third. But I've actually got a slide on here on this.

MEMBER STETKAR: Okay.

MR. REMER: But, you know, might as well talk about it now. Yes, there are new Aging Management Programs. And rightly so. I think what you're looking at here is the fact that if this plant just operated 40 years, there's --

When I started back in '82, there were just some components that you never paid attention to, because they were going to last for 40 years. You didn't need to look at them. And so with the thought of, hey, this thing is going on, it's not that it wasn't degrading, okay.

Age related degradation happens from day one. Everything is falling apart. This table's falling apart. Concrete's falling apart. Gold is falling apart. I mean, when I got into this license renewal thing, I just, I got depressed one day, almost like. It's all falling apart, everything.

So it's not the question, does it age? And you have some degradation. It's how you're managing it. So the thought about new programs. I think some of our slice and dice, to come up with some. Others are brand new, like one time action.

MEMBER STETKAR: That's right.

MR. REMER: Brand new.

MEMBER STETKAR: Yes.

MR. REMER: And others, I just have to say it, we should have been doing some of it all along, okay.

MEMBER STETKAR: I just wanted to --

MR. REMER: I mean, really, we should have been watching.

MEMBER STETKAR: Okay.

MR. REMER: We weren't. And so, we've got Aging Management Programs now that hopefully cover the full spectrum. And we'll add some more.

MEMBER STETKAR: Thank you.

MR. REMER: Sure. This is John's slide here. This is his workload coming. Here's license expirations, 2023 through 2030. Here's 2031 through 2049. If we do subsequent licensing renewal, there'll be a lot of plants coming in for license renewal. A lot of work.

I don't know how to estimate how many plants we'll be. But I believe if we continue to operate plants safely, we can get through this economic tough time right now. We'll see probably a few more plants go down. Because they're not economic.

It's not that they're not safe. They're safe. They just can't make a dollar on selling electricity when you have some unfair market conditions. But that's probably for another day.

I would not be surprised if 80 percent of our plants come in for license renewal the second time around. So I think there's going to be a lot of work. I don't see any reason right now, based on our availability and the maintenance, and the safety improvements, why we can't roll into this and continue on with safely operating plants.

CHAIRMAN SKILLMAN: And your guess at 80 percent. Is that truly a Jason guess? Or is that based on some work that's being done at NEI?

MR. REMER: No. We're not doing any detailed work. That's what EIA uses right now, Energy and Information Administration. They use 80 percent. We talked with them. We've had big meetings with them. They have analytical tools. And they're still using right at 80 percent.

CHAIRMAN SKILLMAN: Eighty percent will come in for a subsequent, right?

MR. REMER: That's right. Eighty percent of the ones that are still operating. You know, if we have some more shutdowns then obviously they won't make it.

CHAIRMAN SKILLMAN: Okay.

MR. REMER: So that's the number we're using for it. So John's got to get ready. Just put a beef in there from you for your staff there, John. Thought you'd appreciate that. Okay. And I didn't talk about this with him before, right.

MR. LUBINSKI: Since you brought that up, Jason, you had asked earlier on our estimate of how many plants would come in for licensure. And as Bo said, that's where we believe that Jason and the industry, they know.

But hearing from, you know, the fact that we're only talking four years from now is 2018, and we're really talking about at least three plants coming in, you know, that gives us belief that there are going to be a significant number coming in. We're in the early planning stages.

You know, Jason's certainly talked about the workload and the op years there. And we'll address that as it comes. We have to make it through the first step though, of understanding what requirements are in place, and how do we handle the first couple, before we can move any further.

CHAIRMAN SKILLMAN: Thank you. Jason.

MR. REMER: This next slide just shows kind of to back up that point. We've had a very active industry presence with each other, and with DOE and EPRI, and the regulator in activities that have to do with license renewal and subsequent renewal. We have the NEI license renewal and SLR task force. We meet regularly with the NRC, on a quarterly basis. We're available to do industry peer reviews.

So when a plant comes in with a license renewal package, it's been through at least a couple of peer reviews from the industry. And that comes from this organization here. Out of that organization we have discipline working groups, mechanical, electrical, civil, implementation and SLR.

Those groups keep up to date and up to speed on all the technical issues that have to do with a license renewal and aging. So we have, this composes probably people that come and participate, maybe 80 or 90, or 100 people. So it's the experts across the field. It's kind of like, license renewal sort of tailing off, and SLR sort of picking up.

And so the interest has kind of picked back up. And so we've seen a little different participation. It's picked back up now, because people are saying, hey, we need to get ready for SLR. So we also formed an executive working group, formed of vice presidents and above, that are interested in having their utilities consider license renewal.

Also, there's the ASME, a special working group, and a lot of other technical working groups that are considering this particular issue.

MEMBER RICCARDELLA: Is that under Section 11, that ASME group?

MR. REMER: This is a particular group. I think, as far as I know they're trying to deal with the changes in Code that would be mandated because of going to 80 years. And so there's definitely a lot of other groups that are looking into this. But this particular one is -- Okay, Al, go ahead.

MR. FULVIO: Just that one.

MR. REMER: Oh, he knows about it. Because he just got back from the meeting.

MR. FULVIO: That one was with NRC. It's a Section 11 group.

MEMBER RICCARDELLA: Okay. Thanks.

MR. REMER: Okay. There you go. Okay. We're also closely coordinated with our associates you'll hear from in a little while. EPRI has got a very robust and accurate program. DOE also very well coordinated, coordinated with us, where we believe that they're working on research that needs to be done to support and help the industry go forward in this area.

We also have a variety of meetings. Some of them I've mentioned already, DOE and NRC sponsored, and two international conferences, really three. We've had a couple of long term operation forums. We've had significant NRC presence.

And it's been mentioned already, NRC and EPRI has also been working with IAEA on the development of our GALL, which basically should tell us something, when the international community basically takes our GALL and says, this is a great idea, and adapts it and uses if for their own benefit.

I mean, Al could, you can spend two hours talking about our GALL. So anyway, very substantial effort there. Here's just an example milestone schedule. Read this from the top to the bottom.

Our first license expires for the first plant that has license renewal at 2029. We want to get, you have to get the application in five years in advance to take advantage of timely renewal. That means you, by 2020 the license has to be approved by the NRC. Two years to do that. We need to get it in by 2018. Two years to prepare it, about 2016.

And you can tell, we're almost, we're behind. And that only leaves us four years of margin right up here. That's not very good. We're behind the first time we did license renewal, as far as our schedule.

So I present this just to show, you know, I used to think, oh, we've got a lot of time, 2029, you know. Some of us will be gone doing other things. But it's here. It's upon us. So these are current issues. Things, and again, I appreciate this opportunity to share this with this panel.

We had developed a rug map that that schedule's part of, that seeks to identify the actions and deliverables necessary to get us to that first plant application. All the players are identified.

And we're actually trying to set up a

workshop right now to go through and get more industry feedback, and stakeholder feedback, so we make sure that we can get a plan that will take us to that first application. Again, we mentioned that 2015 announcement, and the first application in 2018. Okay. So a little bit about -- Yes?

MEMBER STETKAR: On the previous slide, I was trying to look forward. And maybe you're going to cover it someplace, or maybe not. We had some discussion about, this morning, the technical issues --

MR. REMER: Yes.

MEMBER STETKAR: -- that have been identified for SLR. And you mentioned that, you know, that you're obviously involved with EPRI, DOE and the NRC in that research work. Do you feel that the issues, from NEI's perspective, do we at least have the right set of issues?

MR. REMER: We've spent, and this is, they're going to cover it really well.

MEMBER STETKAR: Okay. Okay.

MR. REMER: But in summary --

MEMBER STETKAR: I'll wait --

MR. REMER: I'll just say --

MEMBER STETKAR: I'm asking NEI --

MR. REMER: I feel really good about where we're at.

MEMBER STETKAR: Yes.

MR. REMER: Because we, over a couple of years now we've combed through the data two or three times to try to dig out what are the most important pieces. And I believe you'll see from their presentation that we're fully integrated with where they're at and what they're doing.

MEMBER STETKAR: I was asking NEI, because sometimes the people who are the recipients of this have a different focus than the people who are getting paid to do research.

MR. REMER: Yes. I worked for DOE for a little while. And I understand the research never ends. Kathy's back there making faces at me. Yes. Research will never end, it will never be done.

MEMBER STETKAR: Okay.

MR. REMER: But yes, I fully agree. And I feel fully coordinated with them in that. And we do with the industry.

MEMBER STETKAR: Okay. Thank you.

MR. REMER: Okay. So a little bit about the

Aging Management process. If the two principles are the foundation, then Aging Management is the heart of our license renewal. These are just a list of some of the AMPs out there. I had Alan go through and just check off which ones were based on existing programs.

And, you know, at least from this list, about half of them are based on existing plant programs from the start of the plant operation. Some of them are improved. They're all improved in some way. Some are brand new. One time inspection was a great idea.

MEMBER STETKAR: By the way, my comment earlier when, I probably was too glib when I distinguished between existing and new. I include in new ones that have been enhanced --

MR. REMER: Yes.

MEMBER STETKAR: -- for consistency --

MR. REMER: Okay.

MEMBER STETKAR: -- with the GALL --

MR. REMER: I need to be right about that.

MEMBER STETKAR: So a lot of the --

MR. REMER: Absolutely.

MEMBER STETKAR: -- existing ones are --

MR. REMER: Yes. And if we said this is the list from the start of the plant operation that was changed, then we wouldn't be true to what we were saying about O&E and self improvement. Probably all of them have been majorly changed and improved.

MEMBER STETKAR: Yes.

MR. REMER: You know, back when I started in the plant LUVAL analysis, you know, we were nowhere. Now you have a laboratory on your table that can do as much analysis, all the analyses that you need to do most tasks. So the whole process has improved greatly through the years.

Just a real quick point here about, there's been some discussion of how do we know this thing is working? This is the ten elements that are listed in the GALL that you have to go through as you're preparing an application.

And so you have a confirmation process, which basically says, how do we make sure that the AMPs we put in place are effective? And you have to list what you're doing to make sure they're affective.

We believe the processes we have in place at the plant to ensure effective Aging Management Programs, just like our other programs have to be effective. If they're not effective, then you begin to see degradation of physical condition, performance, of safety.

And so we'll be talking a bit more about some details of that. But I just want to let you know that this is already a very much embedded process in our systems at the plant.

CHAIRMAN SKILLMAN: Please go back --

MR. REMER: Yes.

CHAIRMAN SKILLMAN: -- to the previous slide. Where is the challenge and oversight for the robustness of this process? Where is the challenge?

MR. REMER: Like, what's hard for us to do?

CHAIRMAN SKILLMAN: No.

MR. REMER: Is that what you're saying?

CHAIRMAN SKILLMAN: Where's the adult supervision that says, hey, wait a minute. This is not good enough. There needs to be Number 11 or a Number 12.

MR. REMER: Yes.

CHAIRMAN SKILLMAN: Or the adult supervision that says, this might not be perfect. But for what we know today it's 99 percent of what is needed --

MR. REMER: Right.

CHAIRMAN SKILLMAN: -- for safety. Where

is the --

MR. REMER: Okay, well --

CHAIRMAN SKILLMAN: -- administrative oversight to make sure --

MR. REMER: Right.

CHAIRMAN SKILLMAN: -- that this is --

MR. REMER: Okay.

CHAIRMAN SKILLMAN: -- sufficient and thorough?

MR. REMER: It starts with you all. Because you review the applications. And this is in the application. That's where it starts. If it gets approved by the staff it goes and gets integrated in the plan.

CHAIRMAN SKILLMAN: So, you all is --

MR. REMER: You all is this --

CHAIRMAN SKILLMAN: -- the NRC?

MR. REMER: Yes, the NRC.

CHAIRMAN SKILLMAN: The NRC processes?

MR. REMER: This Board here reviews every application which have these parameters in it. Once it goes into the plant, then the NRC performs a series of inspections.

CHAIRMAN SKILLMAN: Okay. Before it gets

to the NRC thick magnifying glass --

MR. REMER: Okay.

CHAIRMAN SKILLMAN: Where is the peer review? Where are the people that are --

MR. REMER: As far as setting this up, and getting it going?

CHAIRMAN SKILLMAN: Making sure it's sufficient and thorough.

MR. REMER: Right. So what we have is, people that prepare license renewal packages today have been through many, many before. And so we've developed best practices.

CHAIRMAN SKILLMAN: So those people are utility people? Or in the --

MR. REMER: Yes. Utility people and some contractors that -- I meant to bring the GALL Report, but it's like this thick. There's been so many of them done, and so much back and forth with the NRC, the lessons learned have been incorporated into the processes.

So that when we turn in a package today, you fully expect it to not have a lot of problems. Because we've been through this so many times. So the confirmation that's working is the experience that is through the years.

MEMBER STETKAR: Jason, there's one thing about the process of getting the initial license, and the then the license renewal through the approval process. I think Dick's asking about, once it's approved, and these --

MR. REMER: Right. Okay.

MEMBER STETKAR: -- processes are in place --

MR. REMER: Can I go to the next slide? I think this is going to answer your question, if it's about maintaining the effectiveness of Aging Management Programs. Was that your question? How do you make sure that it is maintained?

CHAIRMAN SKILLMAN: My concern is complacency.

MR. REMER: Okay. Right.

CHAIRMAN SKILLMAN: You get to a point where you say, by golly, this is a great program.

MR. REMER: Right.

CHAIRMAN SKILLMAN: The book's closed, and we're going to march.

MR. REMER: Right. Right. Okay.

CHAIRMAN SKILLMAN: And two months later

someone squeaks from France and says, guess what I found?

MR. REMER: Right. Right. Okay. Well, take a look at this. This tries to lay out how it actually works in our utilities and our plant. So you basically start out with plant specific OE, or Industry Operating Experience.

It could be international stuff, codes and standards, research, the GALL Report come together to help us develop Aging Management Programs. We've got a list right now in GALL that's going to be updated soon. I think we've got on the order of, how many ISGs open, like maybe 20 Interim Staff Guidance documents that the staff has put together.

So those are issued on a periodic basis two or three times a year, we get something new. And so all those come together to bear upon developing Aging Management Programs that work. And they're accepted by the staff. We implement those.

And we ask ourselves, do we meet the criteria for effectiveness? And if we did, then we continue monitoring. If we didn't, then it kicks out to our plant Corrective Action Programs. If we find deficiencies occurring in our systems out in the plant, the Corrective Action Program documents, I mean, it's down to a quite low level of documentation in the plant.

To say, hey, this isn't working. Or we're finding issues that we shouldn't find. Those issues are evaluated. And we then either correct the problem by repairing or replacing it, and/or modify the Aging Management Program.

Exactly what Bennett was saying earlier. We modify the AMP, and then it kicks back in there. And then you have a better, better Aging Management Program.

Many plants do a very formal self assessment right now. Many of the programs are mature. So something like a chemistry program, that has a very detailed assessment report to it. A very, very detailed criteria.

A slide further back we'll be talking about some of the initiatives that our industry's taking to actually, let's just say more harmonize how we all do these self assessments. Because we want to do a better job with this than we've done before. So, I don't know if that answers your question or not.

CHAIRMAN SKILLMAN: Well, I heard in an earlier presentation a concern about ensuring that the

AMP is a living document.

MR. REMER: Yes, right.

CHAIRMAN SKILLMAN: And I think that's what you are trying to communicate.

MR. REMER: That's exactly what we're trying to communicate. And it's, what we do is, we integrate it into the plant procedures. So, just because we don't keep a document that says Aging Management Program document up to date, that's a submittal.

We update the program documents, which are the procedures. So the procedures are integrated throughout the plant life, just like EQ would be, just like human performance would be, just like any, a plethora of different programs we have out there.

Aging Management, as important as it is, is really just one program out of, literally I would say hundreds of programs. Alan, help me. When you say hundreds of plant programs we have out there, we integrate it so it's not a separate thing, but it's one with the other programs to maintain safety in our plant. Alan Cox with Entergy.

MR. COX: Alan Cox with Entergy. Yes, I don't know if call them programs, activities. There's a lot of other activities that we do at the plants that are independent of Aging Management. And I guess those things are implemented through procedures. And we make procedures.

Jason mentioned program basis documents. The program basis documents are prepared a lot of times in support of what goes into the license renewal application. And an individual utility may decide not to maintain that as a living document and have it updated. But as Jason said, the details of that are in the implemented procedures.

So if we have OE that says we need to change something, we'll go change the implemented procedure. And there'll be a description in the front of the procedure that says, here's why we made this change. And it will reference the Operating Experience that led to that.

MR. REMER: Yes, good. Thank you. And, you know, the other thing that's a little tricky too, you have maintenance rule that we're going assume it's going to cover Aging Management for active equipment.

That's kind of the implicit thing we're talking about. I think it was even identified in the SECY. But for passive equipment, you know, Aging Management Programs are what we use to maintain those programs, nothing else. Okay. So --

DR. SHACK: When you say modify the AMP, how is that experience transmitted to the rest of the industry --

MR. REMER: Okay. Good point.

DR. SHACK: -- and the NRC?

MR. REMER: Good point. So right now, if it's a significant issue in a plant it gets reported up to INPO, if it causes a transient or affects the safety system. All the plants maintain their own history of what they've done.

As part of our, as part of this group right here, this implementation working group that meets on a, two times a year, they share Operating Experience. And they say, hey, when we were doing this, this happened, and we did this.

Some of that information is available through INPO. Some of it, however, doesn't get to the level that we would report to INPO. That's one of them issue we're taking at the plant is, we are developing guidance to drop that threshold for passive, long lived equipment. So we can better share the OE data amongst ourselves.

License renewal and passive, long lived

equipment is a little bit like comparing a glacier to a river. Maintenance really deals with things that are moving fast and going fast. Passive equipment moves very slowly. Things happen slowly. They degrade slowly, but they still degrade. They're still moving.

So you may not see it in the same kind of time frame. It's way slowed down, because stuff happens slow. So you might not see it as fast as you would a maintenance rule. But when OE comes in as significant, it isn't -- We'll evaluate it.

DR. SHACK: You have a very formal program for --

MR. REMER: Yes.

DR. SHACK: -- the buried pipe.

MR. REMER: That's right.

DR. SHACK: And I just sort of wondered, how many of the Aging Management Programs have something similar? Or is that a kind of unique program?

MR. REMER: We're basically going to take, using loosely, modeling after the buried pipe program for all passive, long lived equipment, that you can report that kind of data to INPO. And then it will be available to the industry.

It's also available to NRC. NRC presently gets all the OE data from INPO right now. You don't get the tools, they don't get the tools to assess it. But it's all available.

(Simultaneous speaking,)

CHAIRMAN SKILLMAN: What frequency does your procedure require you to update the AMP?

MR. REMER: As far as for new information?

CHAIRMAN SKILLMAN: I'm going to use a term that my colleague Charlie uses, a watchdog timer. What's the watchdog timer --

MR. REMER: Yes.

CHAIRMAN SKILLMAN: -- to cycle this, so that the AMP really remains current.

MR. REMER: Right.

CHAIRMAN SKILLMAN: Let me give you an example. I, like you, worked in a plant for a long, long time. We would say we've got about 150 programs, about 75 or 80 are regulatory mandated. Of those, there are about 30 that are critical to the material condition of the plant.

MR. REMER: Right.

CHAIRMAN SKILLMAN: So the question was, how often do those critical regulatory mandated programs get updated? It shouldn't take an event at some far away plant to kick off a review. The review ought to be on some timer that ensures that that program is healthy, or is being adjusted to become healthy. In other words, it shouldn't take an event.

MR. REMER: Right. I agree with you.

CHAIRMAN SKILLMAN: It should be something from within that says, let's take a look. Let's circle back around and make sure that this program is good to go.

MR. REMER: Right.

CHAIRMAN SKILLMAN: So, what keeps the AMP healthy?

MR. REMER: I'll let Al come on up, and I'll start answering this. A lot of the AMPs are on a basis of years between each actual application for the Aging Management Program. You may do an inspection once, and then five years later you'll do it again.

Every time you do that inspection you evaluate the data you have, based on what you expected. And you make an update at that point if necessary. Because if you find what you didn't expect, then something's askew.

So in every case, I'd say maybe with the exception of the one time inspection, which only happens once, you will update it when you perform the Aging Management inspection. I'm going to let Al Fulvio, from Excelon, expand upon, or correct me if I'm wrong.

MR. FULVIO: Yes. Al Fulvio, from Excelon. Excuse me. For our major programs at Excelon, we do a self assessment every five years. The major programs are the ones basically identified by INPO, you know, in their oversight of the industry programmatic activities.

However, for the Aging Management Program, some of them are new programs to the INPO population, if you will. And currently we have in process a procedure to perform that same self assessment on a frequency of five years for those AMPs.

Now, part of your self assessment could be a function of how often you do the activities for that AMP, okay. All AMPs are not the same. They're all actually very different in terms of what they're really trying to do. So, it's not unreasonable for a program that has a high volume of activities to self assess and say, hey, we got to look at this more than every five years.

Or, if you're only doing an inspection

activity every five years, you may say, well, maybe that's not enough. Or if you have two plants on a site, maybe I'll wait for both of them to be done. And that could take, you know, five to seven years. So it is AMP specific. But the generic answer I think is about five years.

CHAIRMAN SKILLMAN: Thank you.

MR. REMER: Thank you. Okay. Moving on. Just to draw your attention to the fact that we update these documents regularly. The GALL is on Rev. 2, and we're talking about another Rev. We have ten Interim Staff Guidance documents that currently are out there.

So basically we have to pull that, and use that as guidance, in addition to the GALL. Recommendations, rather, and guidance. Twenty-three previously closed ISGs. So that the process of change is really, it's happening. We're up to Rev. 6 on the 95-10 document, which is a guidance document for preparing applications.

So there's been a lot of water under the bridge already. And a lot of activity there that I think can show you that this is a living program. A little bit to your point too on plant inspection. Once you get your license you don't just, you don't set it on the shelf. You integrate it into your plant processes.

NRC has a couple series of inspections. They do a license renewal site inspection. Then they do a post approval site inspection that occurs right at the time where you implement your license. They have a Phase 1, Phase 2 and Phase 3 that asks the question, are you implementing what you said you would implement?

Because you might have a license approval. And it may be, you know, seven, ten years. I don't know if that's a good number or not, but at least five or six years. And so you have to ask the question, are you going to implement what you said you were going to implement? So those inspections happen.

Actually, I was at the A&O inspection. And it was good to see, to be able to look and say, you said this in your application. What are you doing here today?

Many times programs are implemented in advance, way in advance of when it was required. But in every case that I saw, this confirms that you're actually putting in place what you said you'd do.

In addition to that, Aging Management has become part of the normal NRC site inspection procedures. The procedures are being revised. And as they're being revised they are being added to with statements like, look at the Aging Management Program for this, or look at the Aging Management Program for this, which I think is a very good step.

Because it again helps the NRC confirm that you're really doing what you said you'd do. These, once you do an inspection, and you may or may not get findings, it's included in the ROP as well. So that's a second level of check that if, at the end of the day it's about performance. If the plant is not performing well, if safety is declining, it will show up in the ROP.

I wanted to mention also, there are three SLR audits, Nine Mile, Ginna and Robinson. I was at Robinson. I read the audit reports. And there really weren't any major deficiencies noted in the report. I know there'll be some follow-up reports.

I was at the exit for Robinson. There weren't any major findings, like, well we can't find this in your processes. You know, a lot of times your transitioning staff, and you're training new people. And there's always little issues here and there. But this would be surprising to me if we used this as a basis for having to do license rulemaking.

MEMBER RICCARDELLA: Are those really SLR audits, or are they LR audits?

MR. REMER: No, they're SLR audits. They were particularly designed to look at, what would it look like if we go past 60 years? And so John and his staff, I think you weren't there for the first two, but you did the Robinson.

MR. LUBINSKI: Yes. Since you brought that up, Jason, if I could comment.

MR. REMER: Yes, please clarify.

MR. LUBINSKI: It's really just not an SLR audit. It was an audit of the implementation program, with the idea that if we identified issues that we believe were important to the current license renewal period, we would address them immediately. So I'll agree with Jason's comment from the standpoint of no major deficiencies.

So from the standpoint of the current license renewal we identified no major issues or deficiencies that would require something to be done for current license renewal. The first license, you know. They're being used to help inform what we're doing in developing Subsequent License Renewal.

So there were really two parts to that. And we haven't referred to them as either license renewal or subsequent License. We've referred to them as AMP audits.

MEMBER RICCARDELLA: Okay.

MR. REMER: Corrected on that. All right. Okay. So, let's look at a detailed analysis of the SECY paper now. I won't bore you with the two principles for licensing. I think you've seen it about five times now. And so this is highlighted.

We do again want to commend the staff for the work they did on putting this SECY together. It's a really good document that goes through the history of license renewal. Many good hours have been spent on just pulling it together, thinking about it.

They held a series of public meetings. I think we had three public meetings. Collected public input. A lot of good stuff has gone into it. And we were very grateful that they came down on the same side, as far as the structure. The basic structure of license is sound

And so there's things we definitely want to agree with, that the license renewal process and regulations are sound, and can support Subsequent License Renewal. Environmental issues are presently addressed in the guides. We agree that it's helpful that NRC revise the GALL Report, but not essential.

We're actually not going to be able to answer all technical questions out to 60 or 80 years. Because there won't be the data there to answer every single point. We haven't answered the questions for license renewal all the way up to 60 years.

But we have a process that works it, a process that does inspections. We have R&D coming in. And when we see divergence in those, then we take action. But we're not going to be able to look at the crystal ball.

But we have programs in place that have been the foundation for license renewal. We also agree, no need for applicants to include PRA update, because no unique nexus to SLR.

MEMBER STETKAR: Jason, on that last bullet there, we hear a lot that you can't, you can never justify the PRA if you look at each individual issue in isolation. That's what we continually hear.

You can't justify it based on SLR. You can't justify it based on anything in isolation. What's

NEI's position on PRA in total, for the integrated safety of the plant?

MR. REMER: Well, I do have an associate, Victoria Anderson, here. Victoria, are you here?

MS. ANDERSON: Yes.

MR. REMER: She can come up as -- She's coming up. We have a very, we have an appreciation --

MEMBER STETKAR: You just said --

MR. REMER: -- for this area. And we want to include it when we can. And actually as I was, this morning listening to some of the things that were talked about, I was part of the maintenance rule, and did configuration management. And did the whole reliability center of maintenance. So I saw what it did for active equipment, and how it really improved the process.

License renewal right now is very deterministic. It's 100 percent deterministic. And so there are advantages to be had. But our point right now is to force it on us because of SLR would not be appropriate. So I'm going to ask Victoria. Victoria, our feelings about the PRA.

MS. ANDERSON: Our feelings about the PRA in general?

MR. REMER: Yes.

MS. ANDERSON: Well, I guess first I have to introduce myself. Victoria Anderson, from NEI. I think we do see lots of great benefits of PRA. And that's why you've seen so many utilities take advantage of so many of their informed applications. And why every single licensee, reactor licensee has a PRA of some sort.

Pretty much everybody has an internal event PRA. And almost everybody's had one of their PRAs peer reviewed. So people are very much committed to achieving quality PRAs and using them in the regulatory process. I think as far as Subsequent License Renewal, we need to be concerned about expanding requirements that may not be beneficial.

For the most part an internal events PRA for many applications, and for applications such as maintenance rule and giving you information about condition monitoring, and many of the applications we can envision for Subsequent License Renewal, many of those can be accomplished with the internal events PRAs that the licensees all have, and all maintain for various purposes.

So I think there is a place to possibly in the future consider using, giving an option for using risk information to better focus some of the work done in support of Subsequent License Renewal. But I don't think that that would call for necessarily having a full scope PRA. Did I answer the question?

MEMBER STETKAR: No. But that's -- Thank you.

MS. ANDERSON: Okay.

MR. REMER: I think --

MS. ANDERSON: Okay.

MEMBER STETKAR: You've cleverly focused on internal events for full power, and discussed that, and then jumped to Subsequent License Renewal. I was asking for NEI's position on the use of PRA to support a wide variety of initiatives for safety, one of which is Subsequent License Renewal, and only one of which. And not everything is driven by internal events for full power, as we have learned from doing fire analysis, for example.

MS. ANDERSON: Right. And if --

MEMBER STETKAR: And if you did shut down analysis you'd learn more. And if you did a seismic PRA you'd learn even more. And if you did a full scope Level 2 PRA you'd learn even more.

MS. ANDERSON: Right. I think that as those applications become available, people will develop those models, and will --

MEMBER STETKAR: Well, the key is, people are not doing that. So I'm asking, from NEI's perspective, speaking for the industry, why aren't people doing that?

MS. ANDERSON: Well, I think --

MEMBER STETKAR: Because you can justify the fact that it's not economically justified, if you parse down the little applications finely enough in your little spreadsheet. It's never justified for that little single cell in your spreadsheet.

Or you can say, it's internal events at full power, with these other restrictions. It's probably good enough for this one little cell. I'm asking the broader question.

MS. ANDERSON: I think that there is actually a lot more development beyond internal events PRA than many people are aware of. We actually just recently took an inventory industry wide. I think it was sent to the Commission in a December 19th letter, which I'm sure the ACRS is aware of.

So there is work going on in that area. And we are supportive of it when the models can be applied. And I think as we pilot the methods as they're developed, we identify potential applications. So I think it will come. But I think if it's forced, you won't necessarily get the best results.

MEMBER STETKAR: Okay. Thanks.

MR. REMER: Thanks, Victoria. Okay. Moving on, this is just kind of overall concerns with rulemaking. We believe the current suggestions for entry into rulemaking would be overall out of step with the implementation of cumulative effects of regulation process changes.

Those have to do with a lot of input up front, better estimating, implementing the guidance, or sending out the implementation guidance along with the draft, those kind of things.

The second item is, we haven't seen a significant issue, inspection finding, audit report, or implementation difficulty, or operational need to implement rulemaking. We're asking ourselves, what's the forcing function? We want to improve. And I think we've shown you in this presentation and others you'll see, is that we have improved a lot.

We can't find a forcing function that rises to the level that says, we've got to do a rulemaking here. Because frankly, when you do a rulemaking you spend a lot of money on your side, and on our side.

And we're asking a question, what's the attendant cost and benefit equation? What's the improvement in safety? We don't see any. Or we don't see, we see very little. We don't disagree with most of the points, as we'll get into. But we just believe that they can be implemented in other ways.

The SECY claims improved efficiency, and a more predictable review process. But again, we haven't seen anything backed up with a cost benefit justification or study. Or even stories about how we can improve this. It is a complex process. It's a lot of back and forth a lot times.

But I think we, working with the NRC, have done really well to prepare guidance documents that minimized that. Again, this can be done without rulemaking. Most changes suggested in the SECY are not unique to SLR, and can be implemented without rulemaking.

For these non safety significant issues the schedule for rulemaking may impact industry plans and industry staff resources for our SLR application review. So we may get behind. And we may clog up a process that works quite well right now.

Okay. I want to go through this, because this is just a summary of the proposed changes. But I'll jump right to our opinion about the various -- Option 1, of course, is our choice.

CHAIRMAN SKILLMAN: Jason, let me ask you --

MR. REMER: Yes.

CHAIRMAN SKILLMAN: -- to please target completing your presentation by 15 minutes after 3:00 p.m., okay?

MR. REMER: Okay. I'll be done in a few minutes.

CHAIRMAN SKILLMAN: Okay.

MR. REMER: Thank you. Option 1 is the one we propose and we suggest. We believe Part 54 is sound and robust. And in fact, as I mentioned before, nothing prohibits in the rule right now from turning in another application. Existing regulatory processes ensure safe operation.

We've talked about several of these. Appendix B is a big one. All the plants have committed, in their Aging Management Programs, to utilize the quality assurance aspect of Appendix B for license renewal of equipment. So that's not just covering safety related equipment, but it covers all license renewal of equipment.

So not all the elements of Appendix B, but the reporting and mediations piece. Everybody's committed to in their SAR. Aging Management Programs, they're the heart of the process. They're healthy, they're well. They're improving, they're growing.

Maintenance rule deals with active equipment. We don't see any reason to change it. And we agree with the staff and their assessment. The ROP process is increasingly getting, looking at Aging Management Programs. And so, as we go forward more and more procedures will include looking at Aging Management.

We think it's appropriate and well founded. Through all these things the design basis is maintained. This process is proven through vast experience 73 renewed license, 27 reactor units and the PEO, a reliable, predictable process. Option 2, it's really editorial changes. Really nothing is gained from this. It's just a reference.

MEMBER RAY: Wait a minute. I can't -- I got to say, look --

MR. REMER: Okay.

MEMBER RAY: The experience process has got lots of things in it. We just were talking this morning about the fact that Fort Calhoun got its license renewed, and within a short period of time exceeded its design basis. So I don't want to get off on that track again. But it just seems like an overly broad statement you're making.

MR. REMER: About this Option 2?

MEMBER RAY: About the experience proving the process.

MR. REMER: Fort Calhoun had nothing to do with Aging Management. I mean, that, I understand what you're saying.

MEMBER RAY: It depends on how you define Aging Management. I happen to define it as including the aging of the site design basis, okay. Now, you don't. That's okay. But you're going to get, I think, if you have time, if I don't take too much of your time, you're going to talk about --

MR. REMER: Oh, no.

MEMBER RAY: -- the Fukushima role here in a minute. And I just didn't feel like what you said should go without some response. So, just carry on.

MR. REMER: We don't disagree that if conditions change you should evaluate that. And we just think it should be done now, rather than wait until license renewal. You know, if it's an event, a situation, or environmental condition --

MEMBER RAY: Well, I'm just saying, if that occurs you're going to take note of it. The question is whether the probability of the event is changed. And again, I don't want to delay things. Because we're behind time here now.

But it's really a question of what is the risk of the event occurring, not did the event occur, and did you ignore the fact that it occurred. Clearly you won't do that.

MR. REMER: All right.

MEMBER STETKAR: Jason, because Harold brought it up, I was going to wait until Option 4. But I'll continue this.

MR. REMER: Okay.

MEMBER STETKAR: So we can keep the discussion going.

MEMBER RAY: I just --

MEMBER STETKAR: This morning I asked earlier, and I had to duck out. Plants update their

FSARs every two years. Now, I don't know, we don't look at updated FSARs as the ACRS. Do the plants --

The example I used, do you license the plant 40 years ago, based on five years of meteorological data from some met source 100 miles away from the site? The plant has now operated 40 years. In the updated FSAR, Chapter 2, do plants keep a running total of that information? Do they update the history? Do they update the current state of knowledge about the site environs in the updated FSAR?

So that, for example, as new knowledge about oh, seismicity comes up it's updated in the FSAR. As new information about the trends in rainfall come up, is it updated in the FSAR? I don't know. That's what I'm asking.

MR. REMER: Well, I don't know if, Al, you want to field that question?

MEMBER RAY: He said when you were out that it wasn't required.

MR. FULVIO: Yes. Al Fulvio from Excelon. I do not believe that plants do that. However, when we do go for the license renewal that information is reviewed as part of the NEPA review. And they look for anything new and significant since you originally licensed.

So all of that environmental stuff does get under the microscope in a license renewal. But to answer your question about do we routinely do that? I would say, probably not.

MEMBER STETKAR: Okay. Thank you.

MR. LUBINSKI: Is it possible to interject here? I guess I, responding to Al's comments. There may be issues looked at under NEPA. But that's an environmental review. And your question had to do with the safety review.

MEMBER STETKAR: I had the, yes, it's a safety review.

MR. LUBINSKI: Yes. And unfortunately when you left the room this morning this came back up again, and responded. And I'm going to repeat myself.

MEMBER STETKAR: Okay. I'll go back and look at the transcript and see.

MR. LUBINSKI: Okay. But from that standpoint, when they do it as part of the NEPA review, we do not then look at it as part of our safety analysis when we're looking at the safety review as part of license renewal.

MR. FULVIO: Yes, I'm sorry. I

misunderstood. I thought I remembered from this morning you were giving the example of the meteorological data, is that updated? That's what I remember from this morning.

MEMBER STETKAR: That's, I'll look at the transcript from this morning. Thanks.

MR. REMER: Okay. All right. So, Option 2, editorial changes. Again, I think it's been even mentioned by the staff is that you wouldn't do this alone. Because it's really got limited value. It's an editorial change. And yes, it should be fixed if we can fix it without doing rulemaking.

Option 3. Again, this would apply to all license renewal plants. This issue of timely renewal has been already mentioned at Indian Point. The process was handled extremely well. The AMPs were put in place by commitment. The utility committed to do that. The inspection procedure was written and executed.

And again, this is probably a rare event. It may happen again at some point in time. But I wouldn't suggest that that would be cost beneficial to do, through an event that really has been handled very adequately.

Anybody that would refuse to implement their Aging Management Programs, to enter into the PEO, I would just have to say they would be not very smart. And so I wouldn't say this would be something we have to do.

As far as adding equipment, large area loss of equipment, fire and flex equipment. Currently it's managed by its own procedures. Much of the equipment, I would probably say most of it is not even in the maintenance rule, because it's temporary and portable equipment.

It already is handled through existing plant processes and procedures. It does not need to be added to the license renewal scope. Because if you did add it, it might only be a very, very few pieces of equipment anyway, if any. Maybe a connection here or there, or something like that.

It's just not, again, it doesn't add to safety to a significant degree. It may already be included in our plant, depending on how we implement it.

MEMBER STETKAR: How do you know that it doesn't contribute to safety?

MR. REMER: I'm sorry, say that again?

MEMBER STETKAR: How do you know that it doesn't contribute? You made a statement, well, there might be a few pieces of equipment. But if it applied --

(Simultaneous speaking,)

MR. REMER: Well let me just give you an example. If it's a connection say in the service water header, so you can attach the component. It will be in scope already, because it's part of the service water header. And if it's a, say we decide to do the instrument on the spent fuel safety related, it's already in scope.

MEMBER STETKAR: If it's safety.

MR. REMER: It will be in there.

MEMBER STETKAR: Yes. If it's safety related.

MR. REMER: Right.

MEMBER STETKAR: Okay.

MR. REMER: So, under existing programs.

MEMBER STETKAR: Yes.

MR. REMER: So there wouldn't be any reason to call this out. I think there was a comment made this morning about a more general approach, just to say, look, important things, safety related, it's important to safety ought to be in scope.

MEMBER STETKAR: I didn't say safety related. I said important to safety.

MR. REMER: Important to safety.

MEMBER STETKAR: There's a difference.

MR. REMER: There is. When you say safety and important to safety.

MEMBER STETKAR: And in fact, some safety related might not necessarily be important to safety.

MR. REMER: That's true.

MEMBER STETKAR: It is true.

MR. REMER: The final point. It is true.

MEMBER STETKAR: Well, you saw the slide this morning.

MR. REMER: Yes.

MEMBER STETKAR: Texas.

MR. REMER: Yes. Deterministic world that we live in, it's not the way it is. But I agree with you. Okay. Option 4. We feel like it conflicts with fundamental regulatory principles and the license renewal rule. We believe this is already required as part of the GALL Report.

We're already required to do monitoring trending, Operating Experience, and all this, actually confirmations. We have to say how we are making sure we are maintaining our Aging Management Programs. In addition, 10 CFR 50, Appendix B overall requires these things for all plant equipment that's safety related. And by extension for license renewal equipment, because of our commitments.

In addition to that, we have a couple of industry initiatives underway. We're going to develop a couple of NEI guidance documents that will be committed to all the utilities. That will improve Operating Experience for age related degradation and Aging Management Program effectiveness reviews.

So those documents, much like the buried piping program, will be reviewed and then agreed to by the industry. And then mandated that the industry follow them. Everyone will follow them, much like the buried pipe. And everybody participates.

CHAIRMAN SKILLMAN: Please back up a slide?

MR. REMER: Yes.

CHAIRMAN SKILLMAN: What is your understanding of the robustness of the Appendix B programs for the plants across the country? Do you believe all have really strong programs? Or do you believe some plants have deficient and weak Criterion

16 programs?

MR. REMER: This is the gospel for operating a power plant. If you have a weak quality assurance program you will shortly see it in the results of your operation or your safety factors. Your ROP will suffer. So if you do not have good Corrective Action Program, you do not have a good materials control, design control, storage and safety control, you will shortly see it.

So there are programs that fall into problems occasionally. But you will see that in the actions that are taken to have inspection reports and violations to get it back up to speed. But my experience so far, having been at quite a few plants, is that it is a very robust program at the sites. It's taken very seriously. And to my knowledge, without exception.

MEMBER BLEY: Jason, just a comment on that.

MR. REMER: Yes.

MEMBER BLEY: In some way it supports what you said. But when we look at severe operating events that generate freak inspections and reports, it's not uncommon after those to find that part of the reason for what happened was weaknesses in the Correction

Action Program.

MR. REMER: Yes.

MEMBER BLEY: I don't know how quick you get slapped on the hand for having one. Some of them it looks like they've gone back years with the problems that lived there. So in principle what you say makes sense to me. In practice, I wonder how many holes there are.

MR. REMER: Well, it's a little bit like the Declaration of Independence and the Constitution. It works very well most of the time. But it works because there will be problems. There will be events. Equipment will fail. You're trying to minimize it. You're trying to make sure your programs are strong.

But sometimes programs fall off. And sometimes they're not assessed. Sometimes you have management that doesn't understand. You have cost pressures occasionally. But the programs we have around this, and the monitoring that NRC has, I believe it allows us to quickly find out that, and make corrections when necessary.

MEMBER BLEY: I don't like the way we find out sometimes.

MR. REMER: No. I know that. And I wish --

Yes, I agree with you. I agree with you.

MEMBER BLEY: Okay. Go ahead.

MR. REMER: Okay. So Option 4, energy initiatives underway. And again, if it's important to do, then why are we going to wait 15 or 20 years to implement it? You know, if it's part of the SLR it may actually be 15 to 20 years before some of the plants actually are required to implement these programs.

And we feel like they're already covered in sufficient regulation. We're creating a couple of industry initiatives to improve it. We don't need regulation to do this.

MEMBER STETKAR: Do you have a time schedule for those NEI 14 initiatives?

MR. REMER: Yes, they'll be -- They're drafted right now. And we're in discussions with having the NRC review and approve them, because it's a document. And we're working with INPO to make sure that what we put in place is sensitive to the burdens that are out there right now.

We don't want to burden the utility with another form they have to fill out. So we're going through that process with INPO. We're shooting for the end of the year, or early next year to implement these across the units.

MEMBER STETKAR: That's implement after staff approval? Or --

MR. REMER: I'm not sure how that's going to go exactly.

MEMBER STETKAR: Okay. I'm just interested --

MR. REMER: Yes.

MEMBER STETKAR: -- because these sound intriguing.

MR. REMER: No. It's, we, working with the staff, we saw that these were a couple of areas that we could tighten up on. And we could make information easier to get to. Also, the program effectiveness, make it a little bit more standardized.

Everybody does this already to varying levels. We said, let's just make it standard here. So we feel good about the process. And I think that's a reasonable time frame to implement it.

MEMBER STETKAR: Can I, we should really like to see that one.

MR. REMER: Once it grows a little bit of --

MEMBER STETKAR: Yes.

MR. REMER: We'll sit back in the chair with you. Sure. Great.

CHAIRMAN SKILLMAN: Jason, if I connect the dots in my own mind, what I think you're saying is, we don't want Option 2, 3 or 4. We want Option 1. But we'll do this instead.

MR. REMER: Yes, that's right.

CHAIRMAN SKILLMAN: That's the punch line.

MR. REMER: Well, we're going to do this anyway. No matter what happens we're going to do this. If you do a rulemaking and say --

CHAIRMAN SKILLMAN: So let me state it again.

MR. REMER: Okay.

CHAIRMAN SKILLMAN: You're saying, we don't want 2, 3 or 4, we want 1. And we're doing this.

MR. REMER: Yes, that's right. We are doing this of our own initiative. And we don't believe -- It's not because we don't want more work, or want it better. We just don't think it would justify the safety and the cost, what it would take to actually change the rule. Because we think the rule works very well. And then guidance can implement almost everything that's been mentioned.

CHAIRMAN SKILLMAN: Got you. Thank you.

MR. REMER: Sure.

MEMBER BLEY: Let me ask you a question. Because nobody's talked about this. From your point of view, your vision, is it that GALL may be updated, maybe not, but it might be. But then the process for Subsequent License Renewal, and the application for that, will be essentially identical to that for a first renewal?

MR. REMER: That's right. Yes. That's right. With the lessons learned incorporated. I mean there --

MEMBER BLEY: I mean, it will evolve.

MR. REMER: The ISGs will be rolled back.

MEMBER BLEY: At any point in time if one plant was coming in for a first license renewal and one was coming in for a subsequent, they'd do the same application? They'd do all the same things?

MR. REMER: That would, yes, I think that would be, well, that's what we suggest in general. I think right now I'm not sure where the GALL is going, if it's just going to apply to SLR. I think that's still a discussion, John, right now.

CHAIRMAN SKILLMAN: Let's -- You got two minutes.

MR. REMER: Oh, two minutes. Oh boy. I better make it to the points here. I don't know if I answered your question or not. So, limited time, we can do the application. Since, by the time you get to the second round of renewals you're going to have so much Operational Experience on the AMPs you really don't need any more.

And the only reason somebody's going to turn it in 20 years beforehand is if they have another sister plant, they want to do them together. And so, we don't believe this will be any benefit at all to this. Because we'll have tons of OPE before that. We've already talked about this. I'm not going to talk about it anymore.

Summary, future of license renewal depends on certainty in the existing regulatory process, in the regulatory process. Existing license renewal regulation provides a solid foundation for safe operation.

The schedule is tight, compared to the first round. And if we do rulemaking we may compromise the rulemaking schedule, or the SLR schedule. Criteria for rulemaking is not supported by increase in safety, nor efficiency improvements. Thank you very much.

CHAIRMAN SKILLMAN: Jason, thank you. To pause for my colleagues, any questions for Jason? Okay. And I admit I'm pushing for schedule, because we may have travelers that might want to go back to the West Coast. So with that, I would like to please call Sherry Bernhoft, from EPRI, to come forward.

(Pause)

MS. BERNHOFT: Is my presentation loaded on here?

CHAIRMAN SKILLMAN: This is a low budget operation. You get to do your own -- Where's Kent? Hey, Kent?

FEMALE PARTICIPANT: You might find it's there if you close that one, and see what's on the desktop. Usually it's on the desktop somewhere. And so, one of these looks like yours, right. The one that's on top I think is yours, because I just opened it.

MS. BERNHOFT: Oh, okay. Thank you.

FEMALE PARTICIPANT: No problem. You'll get my bill.

MS. BERNHOFT: Appreciate that.

FEMALE PARTICIPANT: Okay.

CHAIRMAN SKILLMAN: Sherry, welcome to you.

MS. BERNHOFT: Well, thank you. I appreciate that.

CHAIRMAN SKILLMAN: Thank you for coming here today.

MS. BERNHOFT: I'm glad to be here, now that I've figured this all out. And we can probably do that. If it will do it for us. Clicking the right buttons?

MALE PARTICIPANT: Do the F5, F5.

MS. BERNHOFT: F5? All right. I'm ready to drive. Well, thank you for letting me come talk to you this afternoon.

CHAIRMAN SKILLMAN: Thank you, Sherry.

MS. BERNHOFT: I do appreciate that. I'm going to talk to you. I'm going to give you just a couple of quick overviews on what it is, EPRI is. I just, I don't know if any of you had an opportunity to talk with us very much.

We do have our mission. It's safe, reliable, affordable and environmentally responsible electricity. We do have four sectors in EPRI, one of which, the largest of which is the nuclear sector, where I work. We do cover all of electricity and generation. So we have a couple aspects I want to make sure we understand.

One is that our nature is we are funded by the utility members. I mean, that's who pays the bills. But with that we strive to stay very independent in our research. And they actually want us to stay independent, and challenge us to stay independent.

We have a utility advisor structure that helps us make sure the research is relevant. It coordinates with their needs. But we actually hold back quite a bit of our budget too, to do strategic long term work. And that's a part of the governance that we have with them. And we are a non for profit organization as well. And we heavily collaborate.

One thing you'll hear is that EPRI, even though it's a research institute, we're really more of an applied development type work. That's why we partner so well with the Department of Energy, Light Water Reactor Sustainability Program that you'll hear about next. They do a lot of the fundamental research.

We really work with them on a lot of the applied applications from that research. So it's a very beneficial. We have other organizations that we work with that way. In the nuclear sector we do have a number of key drivers, you know, maximizing the safety, the existing assets. We have a large program for deploying, working on the advanced technologies.

And of course, what we're here to talk about today is the work that we do for long term sustainability of the current fleet. So the EPRI program for long terms operations, similar to, you know, what you've heard previous discussions. NRC and DoE hosted some workshops around 2008, 2009 time frame, talking about the question of what would happen with 60 to 80 years.

The EPRI program for long term operations formally started as a program area in 2010. But what it does is it integrates all across EPRI. And I'm going to talk about, in my presentation, the different EPRI technical areas that we integrate across.

And what we do is we go to those program areas, and we incrementally say, if the plant's going to operate for 60 to 80 years, what in your program area do we need to do in addition to what you're already doing now, to give us the tools for safe, reliable operation for 60 to 80 years?

And we also pose the question also, are there ways that we can look at economic enhancements for the fleet of plants, if they're going to continue to operate? Can they also be economic to do it?

Because as you heard Jason say, if you're the plant operator a lot of your decisions are going to be, can I economically and safely operate the plant? So that's an important part of it too. So we integrate. And we also do quite a bit of collaboration at Department of Energy, that you'll hear about.

NRC research, you heard Mirela talk about some of the programs that we work with with her staff, very helpful. We work with EDF quite a bit, with support with NEI, the owners groups, IAEA. We work quite a bit with the Japanese, and of course universities. So it's a big part of our job.

So Aging Management. We've talked a lot about, you know, what is in the Aging Management. And this is kind of a graphic. It's the plastic bathtub curve that we're all used to seeing. And quite honestly, when you're in the plant you're kind of focused on that flat area. That's where you hope you spend most of your time.

If you invest in your com point, you've designed it, you've correctly installed it, you're hoping that you're going to spend most of your time in the flat part of the curve. So we spend the majority of our research time out on the tail end of the curve.

We want to understand when that tail's going to curve, how we can inspect for it, find it sooner. And then a lot of times we also want to talk about how we can mitigate, you know, slow down the tail end of the curve. And another important part that we do a lot of our research around is, what is the safe end of that curve?

You know, can we start predicting at what point we have to start looking at repairs or replacements of materials, before you start exceeding a safety threshold? Or, as the NRC staff says, what gives you reasonable assurance you're going to continue to operate safely?

So, what are some of the basics for the Aging Management Program, and some of the areas that we do research? We do a lot of fundamental research to help us understand the degradation mechanisms, the failure modes, growth rates. And then we do a lot of things, what we call these inspection and evaluation guidelines.

Again, this is kind of a hand off between the fundamental research, and then the applied work that we provide to the utilities, which are these inspections and evaluation guidelines. We do quite a bit of work on inspection methodologies.

If you've ever been to our center in Charlotte, our NDE Center, that's really one of our jewels. Something we're very proud of is our non-destructive examination center. The qualification that we do there, we support the entire world with qualifying techniques, testers and methods.

Mitigation strategies. We have a very aggressive work in our chemistry. It's not just to maintain the plant. But we do a lot of work on understanding how we can improve the plant, and mitigate system and components, or chemistry, different stress relieving techniques, weld overlays.

We also do a lot of work in the condition monitoring. That's on line monitoring, and some of the different in field detection techniques. For example, like with cables, Mirela talked about. You know, we look at doing indenture testing or LIRA testing to help give us some feel for current cable conditions.

We're starting to do a lot of work right now, what we call prediction of remaining useful life. How do you take the information that we gather from our on line monitoring and our detections, and work up the algorithms to come up with, predict, helping us understand the remaining useful life?

And we do have what we call this fleet monitoring software that we're working on developing right now, again, with DoE. And of course, a lot around the repair and replacement decisions. We have, we published life cycle management guidelines for both active and passive components.

We're working on advanced welding techniques. Highly irradiated materials cannot be weld repaired with current existing welding methods. So we're working very closely with Oak Ridge, at Oak Ridge National Lab, to come up with techniques to weld highly irradiated materials.

And then working on the tools, which is, we call it Integrated Life Cycle Management Program. The overall EPRI program, when it was established in 2010, these were all the different program areas. And it's really in three areas that the program provides the leadership for the research. And that's the Aging Management.

And then we have what we call the Opportunities for Modernization and Enabling Technologies. All I'm going to talk about today is the

Aging Management ones. This was a -- I'm going to kind of take a transition here.

This was a report that we recently published. It came out I think in August last year. It's called "Assessment of R&D Supporting Aging Management Programs for Long Term Operations". We were actually asked to do this by our members, by the utilities.

We have quite a few utilities, as Jason said, that we know are actively going through the business phases right now, to talk about, you know, does it make sense for them to consider Subsequent License Renewal? And so they want to know, as well as the NRC staff and everybody else wants to know, are there any unknowns out there?

Is there any research we should be doing that we aren't doing? How much of my cables am I going to have to replace? Is my vessel going to make it? I mean, just from a pure economic business sense, we could ask that question. And I've heard it.

So we have a couple of different ways that we've gone around, making sure that we are doing all the correct research, or all the right research in the right time frame. I'll talk about some of those tools when I get into the detailed program areas.

But our members came to us about a year and a half ago. And they said, help us understand when we look at the Aging Management Programs, are we doing all the research that we need to do, based on GALL Rev. 2, to implement GALL Rev. 2? Asking the question of what's going to happen 60 to 80 years.

And so this was a program that we undertook. We went through all the Aging Management Programs. And we went through and we mapped the EPRI research to those Aging Management Programs. And we put out a publication there.

And to help, in our simple minds, how to do these things is, we put the Aging Management Programs into three different categories. We said, there's a category of Aging Management Programs, whereas we talk about the question of 60 to 80 years.

Additional research is still needed. And I'll kind of jump ahead of it. It matches very closely with what Mirela, you know, presented this morning with the IASEC, the internals, the cables, the concrete, you know, we agree. That's what that showed us. We found that there are, so if you look on this ongoing research areas, there are eight of those.

We also looked at, a number of the Aging

Management Programs fell into what we call this established program area. That was 20 of those. And some of the examples we have are like the chemistry programs, steam generator inspections, flow accelerator corrosion.

And the characteristic there is yes, we're seeing aging characteristics. We're seeing, you know, mechanisms happening in those systems. But they're well understood. We have established, strong programs in place that are providing the management for those. And we'll continue those.

I'm going to show you a few examples in my presentation about how that work will continue to support those established programs. But those are well established programs. And then there were 22 of them that fell into, I think, this category that we talked about, are these new, of the plant specific, one time inspections.

Areas that, if you're going to go into an extended period of operation, you should go out and look at. But not necessarily areas where research is going to help you inform or improve how you're doing those Aging Management Programs. So we did this to help really focus, and then go back and challenge ourselves.

Are we doing the right research to support our members going forward, as they're thinking about 60 to 80 years? And where their risk could be. And I know you posed that question to me when I first came in. So I hope this helps you with that.

CHAIRMAN SKILLMAN: Yes. As I understand it, this slide indicates the 50 that Tina Taylor mentioned at the RIC. This is that population of 50.

MS. BERNHOFT: Yes. And this is how we broke that down.

CHAIRMAN SKILLMAN: Thank you.

MS. BERNHOFT: And then this is, of those eight that I mentioned, these are those eight Aging Management Programs that we looked at, where, you know, the research will continue to provide insights for the management for the 60 to 80 years.

So, I mean, by default these are our high priority areas. One thing that we found when we went through this, it's important to note is, we had no surprises. This is, we did it, you know, with a clean slate of paper.

But we did not have anything that came out and said, wow, you really should be paying attention to this. You really need a program for this. It did inform us that we needed to adjust some of our priorities.

But nothing came out and said, you know, there's something happening here that we're not covering, or we're not taking a look at. So it was beneficial from both standpoints, help with priorities, and help that we felt that there's nothing unidentified.

CHAIRMAN SKILLMAN: So let me say again what I was trying to communicate.

MS. BERNHOFT: Okay.

CHAIRMAN SKILLMAN: At the RIC what was communicated is, look at 50 AMPs. And of the 50 AMPs, eight really rose to the surface as needing more attention. And on this slide are those eight.

MS. BERNHOFT: Correct.

CHAIRMAN SKILLMAN: These are the biggies. Okay. Thank you. It was very helpful. And, thank you.

MS. BERNHOFT: And understand, this is just an EPRI --

CHAIRMAN SKILLMAN: Yes.

MS. BERNHOFT: -- position with our members.

CHAIRMAN SKILLMAN: Okay. That's good.

Thanks.

MS. BERNHOFT: Okay. And so I'm going to talk about, so now I'm going to talk about each one of these. And I'm going to give you a picture of what we're doing in those areas. Actually, I want to back up on this publication, one thing. I think there's, there is some misconception that came out of the publication.

We put this publication out late last year. We did release it as a publicly available document, because we wanted, we felt this is important information to get out to the general population of stakeholders interested in Subsequent License Renewal. So we non-priced it. We made it publicly available.

We do have a lot of information in there about how we came to our conclusions on these eight AMPs. And we provided a very brief synopsis on some of the research programs that are going on in these areas. And we actually provided some GANT charts on, you know, some timeliness for some other research in these areas.

But I want to make sure that everybody fully understands. In the context of about a, you know, 40 page document, we haven't even begun to touch the research in those areas. So, I would urge anybody looking at this document to take it as a first step. But it is not a standalone document. There are two, and you go to, there are 200 references to this document.

And so to really understand where the research is at this point, you know, you really need to go through those 200 documents. Or, if you call myself, you know, I'll get the smart people to come in, and we'll go through those questions with you.

So don't, again, you can't just take a snapshot of that and think you know everything about every research. It's really just meant to give us kind of a first pass, if that helps. Okay. So I'm going to talk first about RCS metals. And then I'm going to talk about cables and concrete.

Okay. Before I talk about RCS metals, this is our largest area of research. So I want to take kind of a few minutes and describe to you how we approach our research on RCS metals.

The industry itself spends $50 million dollars per year on R&D for RCS metals research. That also includes the owners group in that number as well. It does not include the DoE number. So that's another encrusted number, in addition to that. And we've been at this for a very long time.

And as you can see in NEI Document 03-08, so, you know, from 2003, it's where the NRC, the industry, on their own, the industry management actually came together and said, we need to be pro-actively managing materials degradation issues. We don't like being surprised. We don't like the unknowns.

So the industry came and they established this initiative. There were several meetings of working groups before that. But they actually put a, they put a line in the sand when they put out NEI 03-08. It was a communications document. It's a protocol. And it's also sharing an Operating Experience with each other, and with the NRC. And INPO is also a part of this too.

So, for some of the programs that are under this, like the boric acid program, the vac program, the chemistry programs are all covered in NEI 03-08. INPO, when they do their plant assessments, they go in and they evaluate the plants against those program areas. So like I said, this is a real line in the sand.

The industry came together to help manage their degradation they were seeing happening in materials areas. So we have a number of program areas within EPRI that fall in under that. And that's the BWR vessel internals, the materials, which is the same for all the PWR materials, the steam generators, the NDE, primary system corrosion research, which is, works mostly with DoE, and a lot of the fundamental work, our water chemistry, and our welding repair and technology programs.

I heard some questions about how information is exchanged. Each of these issue programs has a group of industry advisors, U.S. and international. All U.S. industry has a member on these programs. And about 40 percent of the internationals has a member on these programs.

This is one of our largest programs for the international, are these materials programs. They meet two to three times a year, each of these program areas. And a good half day is devoted just to Operating Experience exchange. So that happens up there.

We have a monthly phone call with the leads from all these program areas in EPRI. We have a quarterly phone call with the NRC. We have an annual meeting with the NRC. And if any of that comes up we will set up meetings using this type of a protocol. So it gives pretty quick turnaround.

And like when Ringhals happened, or something like that, we were on the phone right away, you know, going through this initiative. So, how do we, so starting off in some of the materials area, we do have a strategic plan that systematically approaches and evaluates how we manage the materials.

I think some of you may have heard of the materials degradation matrix and the issue management tables. They are both publicly available documents off of EPRI.com. The materials degradation matrix specifically goes through, and I'll show you an example here in a minute. It looks at everything we know about the materials.

We identify the vulnerabilities, we assess the conditions. And we look at, you know, when repair and replacements are needed. We update this at about an every other year frequency. And it's based on research, Operating Experience, and expert panel solicitation.

In 2010 we went through the existing materials management database. It's actually on Rev. 3 right now. We're working on Rev. 4. In 2010 we went through, and this is, you'll see the color coding here in a minute. Yellow is significant. That means those are the gap areas. Green means it's well characterized. Yellow shows the gap areas.

So this is an example of the BWR reactor vessel internals. And you see the little LTO flag up there. That was added in 2010. And the areas that are green, you know, we look at the material. We look at the potential degradation mode that could happen. And then we color code.

If it's green that means we feel like we have adequate information in that box. If it's yellow that means there's still, you know, a gap in our understanding for the research. So when they went through in 2010 and added in these "LTO flags", some of the stuff that was green did go to yellow. But it was a very formal, systematic process.

And there's, this is just one example. I mean, there's tables and tables in this document for, you know, each component that is vulnerable to aging of an RCS metal. So this shows you the formality and rigor of the process it's gone through. So that's just, I don't mean to go into a lot of detail. But I just want to give a flavor.

I've heard some questions, how do we know we're doing the right thing? We've gone at it a number of different ways. So, what we rolled up, coming out of the 2010 effort is shown on this overhead. We went back through the materials degradation matrix.

And we said, okay, what are the higher level items that we see are questions for the long term operations? And you can see they fall into three areas, you know, it's the effects of the increased fluence, the possibility for a life stress cracking initiation, and of course, increased fatigue usage.

So if we go back through and we evaluate what we know, and add that back into the HE management tables, and this made sense with us too. And again, this jives, or aligns very well with what, you know, Mirela presented this morning.

And it's, you know, so from the neutron influences you see the reactor pressure embrittlement. You see the impacts, or the potential impacts from the four internals. The core periphery materials, we're evaluating those. And then, like I said, the late life potential for stress corrosion cracking, and the fatigue usage factors, both from increased fatigue cycles, and also from the environmental effects on the properties of the materials.

We looked at it from the AMP standpoint. We looked at it from the materials degradation matrix. We feel we have identified the high priority issues to be researching. What I'm going to do in these next few overheads is, I'm going to step through what came out.

I'm going to go through, look at each of those Aging Management Programs I talked about. I'm going to talk about each of those Aging Management Programs, and kind of give you a very high level snapshot on where we feel we are with those. And again, this is very high level. I could spend days here. I could get people smarter than I am to come spend days with you on these.

So the first one we talked about is the BWR vessel internals program. And, of course, our issue there is, we want to predict the SEC initiation and the growth trends, due to the increased neutron fluence. And I want to emphasize, as with all the programs, you'll see this repeated.

This is very much of a living program. We work with our utility advisors. GE is actually a member of this too. And we've done an extensive amount of work on IASCC and the BWRVIP documents. In fact, the Aging Management Program for, this particular Aging Management Program references 32 of the BWRVIP documents, the EPRI documents.

And then as I said they're updated and kept current based on our Operating Experience. We've pulled back in the inspection results and the research. This is kind of a busy overhead. But we put this together to show how the different BWRVIP documents are used for a utility that's going through and doing an inspection of their BWR internals.

So you can see all the components are listed that are the internal components for a BWR. You see the inspection and evaluation guidelines. You see how you could look at doing repairs or replacements. And then you see mitigation recommendations.

And I should note too that if you see everything that has the alpha designation after that, that means it's actually been reviewed and approved by the NRC. There was an SER on that. It's an acceptable approach. So if, only four is with the BWRVIP.

We're going to continue a lot of our understanding on the IASCC. And really, where we feel we are right now in IASCC is, we know quite a bit about it. But we need to continue to reduce the uncertainties in the current modeling. We need to look at improving some of the correlations, based on some crack growth rate studies.

And we want to continue working on mitigation and repair strategies. Mirela talked about this today. And I actually have more detail in a later overhead. But I'm going to go ahead and talk about it right now. And that is how important some of the harvesting projects are right now.

Zorita is a plant in Spain. It's a retired plant. It had several years of operations on it. So we worked on a collaborative project with the NRC research. And we harvested some of the baffle plate material from Zorita. Our plan right now is to do some mechanical testing on that, and some microscopic property testing on it.

I had an opportunity to look over lunch, and some of those Zorita materials are anything from a couple of DPA to, there are some that have up to 58 DPA on some of those materials.

Another project that we have relating to the internals materials is the GONDOLE Project. And that's specifically, it's again an internationally collaborated project that's specifically looking at the void swelling properties with exposure to a PWR environment. We have samples of that right now that have 15 to up to 85 DPA of work that we're doing for some void swelling. And then there's another project that --

DR. SHACK: Where did those come from?

MS. BERNHOFT: That's, I can get some more detail on that for you. Let me pull up some more detail. Like I said, I looked up something over lunch, because there was some question about some of the detail. But I'll get that to you. And then -- What's that?

CHAIRMAN SKILLMAN: Just cleared his throat.

MS. BERNHOFT: Okay. Anybody have questions? Okay. I'm ready. And then the Halden research we're also working on. We have some, three or four stainless steel material pieces that were fabricated out of some thimble tubes.

And we're doing some work on that with crack growth rate experience in a lithium environment. Again, typical of a PWR. And we have samples in that testing. And they're in the 60 to 100 DPA range as well. So there's still work to do.

We're still working on correlating these crack growth models. I totally agree with Mirela, the next thing we want to do at Zorita is, that we do have some, like I said, we've harvested these baffle plate materials. We also have some weld materials sitting there harvested.

And our next plan is that we would like to take and further irradiate that, to get that out towards 100 DPA. So, that's kind of the Phase 2 Zorita that's being planned right now. And so, then again, it's, we keep these technical reports up to date. So that's BWRVIP.

DR. SHACK: How about taking some three DPA material and irradiating it to 58 DPA in the fast reactor? And seeing how it compares with the 58 DPA from the LWR? You were awfully dependent on fast reactor radiations.

MS. BERNHOFT: Yes. Just to say, because as you well know, I mean, one of the characteristics we see at the higher watts and the accelerated test conditions, you do see conservatisms. And we see that all over. We see it with cables, we see that with metals, we see that with concrete.

DR. SHACK: If you could convince me it was conservative, that would be fine.

MS. BERNHOFT: Okay. Next one I want to talk about is the Aging Management Program on cracking of nickel based alloys. This is under our materials reliability project, our PWR. And the concern here is, you know, the boric acid crack, primarily the alloy 602 being --

I think we're all familiar of course with the head penetrations and the bottom mounted nozzles in two primary areas of concern. So right now, these are, we have code cases that have accepted by the Section 11 Code, reviewing the examinations, the head penetrations, the butt weld examinations.

We have completed work on the impacts of the leakage on the wastage rates. We've developed the inspection techniques. And we've put out reports on the crack growth rates, and the modeling techniques. And they have been accepted into the Section 11 Code.

Similar to the last situation, you know, the work that we want to continue to do is to further refine the crack growth rate models, looking for the conservatisms on that. And the further work we want to do also is continuing to work on some of the mitigation strategies.

And that's tools such as painting. There are a couple of painting techniques already with the water jet or the laser painting. And we've prepared topicals on that. And there was actually a couple of utilities in the U.S. that are looking forward to wanting to do some painting for stress relief.

But similar to most economic investments, if they make the investment to do it, they want to be able to get some of the relief from some of the inspections. So they're trying to come up with the technical basis to justify that.

We're continuing to work on bottom nozzle inspection technology. It's a very difficult place to get in to apply those somewhat complex geometry. And then, as plants are starting to replace their 600 with 690, continuing to work on 690. Same type of question, that's growth inspection.

And I think as people in the materials world know, we're just trying to get the stuff to even crack, so we can start getting some initiation crack growth rates on it. But first we've got to threaten it enough to crack it.

Next area is, the next Aging Management Program has to do with the thermal aging and embrittlement of CASS materials. There's a lot of CASS materials, cast austenitic stainless steel materials, just outside of the reactor pressure vessel. They're exposed to, of course, radiation environments and higher temperatures.

So the irradiation embrittlement's hot handled under the internals materials. We're looking here mostly at the thermal affects on it, thermal aging. And right now we have a flaw tolerance approach that basically allows you to estimate its time at exposure, and estimate they types of flaws you have.

Our inspection technique right now for cast austenitic stainless steel is a visual inspection. So we are trying to work through, you know, NDE techniques. Again, it's not a very conducive material for an NDE technique.

CHAIRMAN SKILLMAN: Is any of this material in a fluence area where you actually get embrittlement of the austenite matrix? Or is it this is, all the embrittlement is really occurring in the ferrite, either from thermal or irradiation?

MS. BERNHOFT: It's primarily thermal irradiation that we're seeing right now. And probably we'll see it in the ferrite materials that we've seen. But we're still doing some more work on that.

CHAIRMAN SKILLMAN: All right.

MS. BERNHOFT: And we're working quite a bit with DDF on this as well. So there is actually a joint working group ASME put together. And I should say too that there is a list of RAIs that has come from the NRC staff.

And so we have a joint working group between the BWRVIP and the MRP, and several utility representatives that are working on responding to those RAIs, that actually, in the disposition or the treatment of those RAIs, will take care of a lot of the concerns that we feel are going to be in this Aging Management Program for 60 to 80 years.

And that is coming with a good screening evaluation criteria. How we handle the uncertainties and the fracture properties. And there's already been a couple of conference calls with the NRC. And we'll be submitting our response and our guidance documents here in the near future to the NRC on that.

So significant work on that already. But again, we feel a lot of what's -- As that resolution pass is confirmed, that will take care a lot of what needs to be considered for the 60 to 80 in this particular Aging Management Program.

PWR vessel materials, again, very similar to what I covered on the BWR vessel materials. It's covered under the NRP program via -- The issue here of course is the IASCC and the void swelling. EPRI has developed MRP, what we call 227 alpha, which again is an NRC approved inspection techniques.

Plants move into their period of extended operation. They use this as their guidance document for doing a comprehensive inspection of the PWR internals. And we've worked with the owners group to do a lot of the acceptance criteria and methodology, and their W cap.

Right now this is not actually in the GALL. But it's covered by Interim Staff Guidance. I guess it wasn't reviewed and approved by the time GALL Rev. 2 was issues. So as you saw back from that early curve, we have quite a few PWRs that are coming into their period of extended operation. They've started doing this inspection.

Right now, I think best characterizes, we really are not finding any surprises. Some plants are harvesting and replacing their baffle bolts. And so we do have some baffle bolts that, at Oak Ridge right now we'll be doing some further testing on those baffle bolts.

And this is where, I kind of pulled this slide forward. And I talked about that earlier, when I talked about the Zorita Project, the GONDOLE Project, and the Halden Project. So they work together. I mean, it's a similar type material.

But again, understanding, exactly as Mirela talked about, the impacts on the internals materials. So we do have these going at the higher fluence levels. But we do have a program in place, under both PWR and the BWR issue programs to do the inspection, the management and the evaluation criteria.

Reactor vessel surveillance inspections. We talked about that a little bit earlier today as well. Or that question came up. So the need here is to monitor for fracture toughness of the reactor pressure vessels, and the nozzles, due to radiation.

If you look at the red area on the little graphic there on the side. That's just typically what we've looked at, you know, of course, the active fuel area. And your primary concern that started a lot of the PTS concerns was the belt line weld.

As we, more recent experience now, we're actually starting to look at the outside of the belt line area, and in particular the nozzle area. You know, it's more complex geometry of the higher stress level. So we do have a number of reports. So for the BWRs, when they went into the 40 to 60, they relied on the integrated surveillance program.

The PWRs had in place their surveillance capsule program, where they harvest the capsules, and they do their Charpy V-notch test, and put that in embrittlement trend correlation. As we go in --

CHAIRMAN SKILLMAN: Now, there is an MRP report that isn't listed here, that sort of looks at the PWR surveillance capsules, and tries to extend it out.

MS. BERNHOFT: Yes.

CHAIRMAN SKILLMAN: Has that been accepted by the NRC? I mean, is there an evaluation of that?

MS. BERNHOFT: Yes. No. Yes, there is that program. No. Then I'll go right through that right now. So, the first thing we ask --

CHAIRMAN SKILLMAN: The coordinated -- Sorry. Sorry.

MS. BERNHOFT: No, that's okay. It's a great set up. I appreciate that. Not everybody knows about it. It almost made the headlines this morning.

MEMBER STETKAR: Bill knows about everything.

MS. BERNHOFT: So we actually, so there's a need -- As was talked about this morning is, when you have the surveillance capsules, you know, they were put into the vessel at an area that has a lead factor. So we have enough data right now that shows we have a sufficient lead factor, you know, out to the 60 some years of operation.

As we started talking about the 60 to 80 what we've done is, we've done two programs. One is this coordinated reactor vessel surveillance program. We went through the 13 remaining capsules that are still in the vessel.

And we worked with those utilities to extend out the timeline that they would stay in vessel. And so the action that needs to happen there is, each of those utilities needs to send a letter to the NRC, notifying them of that change, that we're going to leave those in longer, to continue to get a larger fluence level out, more representative to the 80 years.

So where that is with the NRC staff, I couldn't answer that. But that's kind of the next action. Those utilities need to process that letter to the NRC staff. The second program that we're doing is, we're actually taking some surveillance materials that have been removed, and putting them back into a vessel.

MEMBER RICCARDELLA: Miniature samples?

MS. BERNHOFT: Some of them are reconstructed samples that been previously moved out. So if they have radiation exposure on them we'll put them back in. And so between the two programs we'll get additional data points out to the 80 years of operation.

Recently we had had some conversation, or I should say the MRP had some conversations with the NRC staff about the supplemental surveillance program, on being able to re-use those surveillance capsules.

There's a tricky nuance in the license renewal language that, working with the staff we're going to be able to overcome that move, and have this program to reintroduce these surveillance capsules. So between these two programs, so again, we've got data out there with a good lead factor on it right now.

And then we're also going to continue to start collecting additional surveillance capsules, to take this out to the, you know, out closer to the DPE, so the exposure's for 80 years.

In addition to that, we're also doing other work on, you know, reducing some of the uncertainties in the embrittlement trend correlations. And we're also working on a project with the Japanese right now to maybe see if we can find a more direct measurement or correlation for embrittlement trend, or for testing the embrittlement versus just doing the Charpy V-notch test. So again, a couple of efforts that will help remove some of the conservatisms in there.

And then the other area, as I said before, that we're working on is, you know, the components are actually outside of the beltline area, the impacts on that. Okay. That's metals. And I hardly did that justice.

I should say that the first week of June our metals researchers, the EPRI issue program leads with their industry chair persons, have a three day meeting planned with the NRC staff. So they will actually go through what I went through in a very few minutes, and give it due justice in three days. And that's a public meeting. It will be here, you know, at White Flint, that first week in June.

Okay, cables. Okay. This is actually under the EPRI plant engineering group. The concerns or issues that we're looking at there are the thermal radiation exposure of cable insulation material. Again, cable research at EPRI has been going on for, you know, 20 plus years. It's a well established program.

Of course, it started with having to do a lot of forensic testing. And a lot of that actually started with, as we talked about earlier today, was some of the results from some of the submerged cables, or cables in leaded environments.

We have several publications out there. They did put out a license renewal electrical handbook. There's been several cable aging reports, guidelines for management of medium voltage. There's one coming out on low voltage cables. And we've done several reports on forensics testing.

And we just recently, I didn't put it on this overhead, but Mirela made mention of it. Did put out a report where we went through working plants. And we collected from 18 different plants the actual temperature and radiation environments that the cables are exposed to.

We've provided that information to our partners through the DoE to Sandia. So as they're doing their continued accelerated aging and radiation testing, they have more representative type data of the plant conditions for that Sandia testing.

CHAIRMAN SKILLMAN: Sherry, what is that image that is presented?

MS. BERNHOFT: Okay. There's two images. The one at the top is what happens. So, sometimes when I make this presentation, you know, I'll make the statement that cables are generally done pretty well in normal environments.

Actually the top, that is what happens when somebody puts a cable, or puts in a valve, a hot valve near a cable train and doesn't shield it. This happened in one cycle to a plant. And then the bottom one is what we call an indenture.

MEMBER BLEY: That was one cycle?

MS. BERNHOFT: I think so. It probably, could have been a couple of cycles. But, you know --

MEMBER BLEY: It must have been a darn hot valve.

MS. BERNHOFT: And then the bottom thing, what that is, is that's what they call the indenture. And what it does is it tests, it takes, it puts the probe against the --

CHAIRMAN SKILLMAN: Insulation.

MS. BERNHOFT: -- insulation material. Thank you. And you look at the elasticity of the material. And we have correlated, there's kind of a criteria. And Sheila can help me here with that too. Is that you get what your elasticity is before you get failure from having to do actually a longation and break test.

So what we try and do is, we correlate what we see coming out from some of the indenture readings to what we see from the elasticity with this. It's just to give us some kind of influence, or insights as to how far we are from potential failure of the cable insulation material --

CHAIRMAN SKILLMAN: Thank you.

MS. BERNHOFT: -- or breakdown of insulation material.

CHAIRMAN SKILLMAN: Understood. Thank you.

MS. BERNHOFT: Sheila, you're standing up. Do you have anything? Oh. I'm not an electrical engineer. I get nervous any time somebody asks me a cable question. So, I still got more cable slides too. Okay.

So we actually, the end of this month we'll be making a technical presentation. We'll have the cable researchers coming to talk to the NRC Division of License Renewal staff at the end of this month, on the road maps with regard to cable testing. We have been working very hard together. And this has been DoE, EPRI and NRC research with Sheila, on developing a joint road map.

And the first thing we did is we went through, similar to what we did on the material with our metals sides, we went through and we had expert teams get together and say, what do you think are the highest priorities to make sure that we've covering for research for 60 to 80 years, you know?

And these are some of things that we saw coming up, with the submergence, the condition monitoring, the degradation with irradiation and actual field conditions, coming up with improved life time predictions. So we came up with those. And then we came up with integrated road maps.

And it's those integrated road maps that we'll be presenting at the end of the month, and our action plans to cover those. Concrete. Any more questions on cables? I told everybody I'm scared of questions on those. Okay. Concrete.

MEMBER BLEY: I'm just curious. There's been a lot of work done recently. And I was looking at your license renewal electrical handbook. But that's some years old now. Is there an update to that coming soon, to bring in all this work that's been done in the last few years?

MS. BERNHOFT: Actually the --

MEMBER BLEY: Or did I miss something?

MS. BERNHOFT: Jason, under his working groups, you know, there is an electrical working group. And they have taken it on themselves. They're going through and they're providing us some inputs to that. So we'll be putting that back out.

MEMBER BLEY: Okay.

MS. BERNHOFT: Okay. Concrete containment structures. This is always a very -- You know, I started working for EPRI two and a half years ago. And I've actually learned that concrete is very, very interesting.

MEMBER STETKAR: We're sick people, aren't we?

MS. BERNHOFT: You know, I was a steam generator engineer for years and years and years. And I used to like really get into looking at, you know, 600 cracking. So I started with a kind of off personality. Okay. So we did have a detailed --

So this is actually covered, believe it or not, under our NDE group. We have a large group, and a growing group right now of concrete researchers within EPRI. And within the nuclear sector we handle all the concrete aging for all of EPRI. And that includes like dams and support structures for large power poles.

So our concrete researchers, I mean, I think they're, you know, they get test a lot, and they're pretty state of the art. They've gone out and they've crawled up and down dams and all that other stuff. And they've talked to like the highway people. And so we get a lot of good cross-pollination there.

We did have a presentation in the December time frame to the Division of License Renewal staff. We did, in 2010, publish a prioritized issue management table. And what we saw was all the issues out there with potential concrete. We also did a detailed literature OE search on any concrete issues that we found in the nuclear industry.

And the best way to characterize it is, concrete again has behaved very well. We've seen a few instances. But they make the national news. You know, like the condition of Davis-Besse, of course, Crystal River --

CHAIRMAN SKILLMAN: Crystal River.

MS. BERNHOFT: -- Seabrook. They make national news when you have a concrete issue.

MEMBER BLEY: Some of the new reactors, not just the one that's been through certification, but some of the newer ones are making extensive use of this steel plate concrete structure, which the last I heard, there's still no standards out on. Have your folks been working on that at all? And is there anything on that that you might point us to?

MS. BERNHOFT: I can find out for you. I know under our advanced nuclear technology group that channels new plants, I know that we have a large track on concrete research with them.

MEMBER BLEY: Okay.

MS. BERNHOFT: So, as far as, you know, the modular construction, I'm not sure if that's something we've done research on, or if the vendors are working on that.

MEMBER BLEY: I did hear a rumor that there's a draft standard finally coming out on it. But it was a big deal here because there hadn't been a standard.

MS. BERNHOFT: I would hope, yes. Good. So, also with the interest in concrete, in 2012 we actually did set up a member advisor group on concrete for EPRI. Some of the issues, of course, were we're well now familiar with the alkali silica reactions, looking at that potential.

And that's what the picture is of. It looks pretty ugly. The impacts of this, we had talked about radiation and gamma heating, and of course, creep fatigue. As we said, we've done extensive data collection.

We have completed just recently a project for all of the existing literature that there is on concrete. I've got a little bit of that in here. I think Tom has some of that in his presentation also.

We provide a lot of technical support on ASR. And we are in the second year of a three year project doing mechanistic modeling of boric acid tagged on spent fuel pools.

So this is classically called the Hilsdorf Data Curve. It's kind of an existing, well cited literature source that talks about the impacts of irradiation on neutron and its compressive strengths.

That's a measurement they've used is, you know, loss of the compressive strength.

And you can see that there's a knee of the curve out there. I'm going to toggle between a couple of overheads here in just a minute. So look where that knee of the curve is. And if you go on to this next overhead what this shows is, this is the PWR fleet in the United States.

We did a lot of work this last year. And we went back, and we asked the question on the PWRs, where would -- The PWRs have the higher fluence in their containment than the BWRs. So we posed the question of, where would be the critical concrete as far a radiation standpoint for the PWRs?

And of course the response comes, you're looking at the biological shield wall and the support pedestal for your reactor vessel. So we went back, and we took, we went through ADAMS. We looked at all the fluence data from the reactors. And we derived, between the air space and the vessel, what we felt at 80 years would be the total fluence level at the reactor support pedestal.

And that's what this data shows you right here. I've taken all the names of the plants off. But you can see that the peak comes with the Westinghouse two loop plants, which makes sense, that they're, you know, much smaller containment, much tighter configuration. That they're going to have the highest fluence levels out to 80 years, around that area, the biological shield wall and the reactor support pedestal.

And so if you look at, you know, the highest fluence plant being that Westinghouse two loop plant, where that level is. And then you go back and look right about where that knee of the curve is on your Hilsdorf data.

So what this tells us is a couple things is, you know, we've got some time, you know, we've got some lead factor on that, based on this data. But what we want to be doing, and we're working with DoE right now, is that we do want to go out and do some additional radiation testing right around where this knee of the curve is, to get some more insights.

And then we also want to do some further modeling and methodistic understanding of, if you do start getting this loss of compressive strength, what does that really mean to the structural integrity of your reactor support pedestal?

So, like I said, it tells us that we're starting to see something out there. But it sounds like we've got some time, you know, there's margin. But taking everything, and fully believing and understanding what it tells us, you know, we also need the reasonable assurance, you know.

We'll continue with some research out in this area to figure out -- So we want to do the irradiation. We want to take that concrete and do some mechanical testing on it, and see exactly how that is changing some of those properties. And also with that too, we want to be developing some NDE techniques.

MEMBER REMPE: So are you grouping all concretes together, whether it's the salt based or whatever, and things like this? Or do you have, do you see any differences in the different types of concrete?

MS. BERNHOFT: Yes. You would see different, for instance the aggregate, the one thing about the concrete that we're talking about is, you know, the good thing is it's a safety related concrete. So there, you know, we can go back to kind of a uniform standard or specification, or criteria that it was, that the aggregate was made to.

(Off microphone comments)

MS. BERNHOFT: Especially when you get to like some of the other concrete around the different areas, you know, it has to be more, you know, commercially available type concrete. When you get to more what's in the reactor vessel support pedestal, it was done to a standard. So we can go back and we can pull those standards.

MEMBER REMPE: Yes. But there is a difference, even amongst --

MS. BERNHOFT: Yes, there is.

MEMBER REMPE: -- the standards. And you can't tell the difference in something like this yet?

MS. BERNHOFT: No, not yet.

CHAIRMAN SKILLMAN: Sherry, how is this information factored into the new construction in the United States, relative to concrete mix, aggregate, chemistry of concrete?

MS. BERNHOFT: That's a good question. I mean, this is fairly recent data. We've made, you know, we've provided like, it's the same concrete researchers that we have that do both. So they've been talking also to our new plant technology people on this data.

CHAIRMAN SKILLMAN: Thank you. That's all.

Thank you.

(Simultaneous speaking,)

CHAIRMAN SKILLMAN: Just, you know, a quick take on that is that the old Westinghouse two loopers are more susceptible to others. But there are a couple of CEs and a handful of Westinghouse three loopers that are not too far behind.

MS. BERNHOFT: Right. And quite honestly, yes, some of the things we've talked about is, and I hate to say this, because some of the Westinghouse two loop plants are the ones that --

CHAIRMAN SKILLMAN: Are susceptible.

MS. BERNHOFT: Well, they're susceptible, and it's a shut down. One already has.

CHAIRMAN SKILLMAN: Yes, Prairie, Kewaunee.

MS. BERNHOFT: Ginna.

CHAIRMAN SKILLMAN: Point Beach, Ginna.

MEMBER STETKAR: This is only U.S.?

MS. BERNHOFT: This is only U.S. data, yes.

MEMBER STETKAR: Interesting.

MEMBER RICCARDELLA: Well, this one, but not that other curve, claiming the drop off.

MS. BERNHOFT: Oh, you're right. This is an aggregate curve. And though we haven't published it yet, there are curves that do show some more recent data that the Japanese have finished, have also --

MEMBER BLEY: At higher fluences?

MS. BERNHOFT: Some higher fluences. But --

MEMBER BLEY: But you only got two points out there --

MS. BERNHOFT: Yes.

MEMBER BLEY: -- at the end. And then you drive your bounds right through it.

MEMBER REMPE: Yes. The two points at the end says no data, right? So those --

MS. BERNHOFT: Yes, those are no, yes.

MEMBER REMPE: -- are somebody's model?

MEMBER BLEY: It doesn't say no data. It says no information.

(Simultaneous speaking,)

MEMBER REMPE: Or what is it?

MS. BERNHOFT: No, those are data points.

MEMBER REMPE: They are data points?

MS. BERHOFT: Yes.

MEMBER REMPE: But we=ve got to see if they=re fast for thermal neutrons or anything?

MS. BERNHOFT: We screened out to, you know, some of the higher -- We did standardize this curve somewhat too, to make sure that we were all talking about the relatively same type neutrons. Tom, what was the neutron load? It came with one grain and 1 MeV on these?

MR. ROSSEEL: I'm sorry. Would you repeat that?

MS. BERNHOFT: We did, when we went through this Hilsdorf exercise we did screen out and try and standardize some of the fluence levels. So we're putting some of the --

MR. ROSSEEL: Generally what we tried to standardize it to, I think, was .1 MeV. And that's one of the things I'll address later on this afternoon, about the cutoff energy. It's quite arbitrary. And in fact, no knowing the neutron spectrum will get you in trouble in the long run.

MS. BERNHOFT: All right.

MEMBER REMPE: So when it has here fast and thermal, or slow neutrons, you've actually tried to correct for that difference? And plot something that's based on thermal? Or --

MR. ROSSEEL: Well --

MEMBER REMPE: -- fast? Or what is it?

MR. ROSSEEL: There's a problem. Trying to go back in time is not easy. We've gone back to the literature. And we've, when you look at those points, they were presented in the Hilsdorf review paper. There's a limited amount of data.

But when you go back to the source material -- And you can come up. And I'll show a slide where we might have 300 or 400 points, you get a lot different perspective on what's happening. But to try and determine the spectrum, unless they give you a lot of information, you're not going to be able to go back and figure that out.

And that's one of the issues that we think is important to look at, is trying to understand the effect of the spectrum. And as the neutrons go through the concrete the spectrum actually changes. Because different energies attenuate at different levels. But I'll show a little bit more of that later this afternoon.

MS. BERNHOFT: So, Tom, through his bilaterals has been able to get some of this data. And so again, what we're finding by doing the literature searches we've done so far is, a lot of the fleet --

I mean, we have some time to work on this, you know, we have some lead time on this. But, by all means, we still need to do work on the tail end of this curve.

MEMBER REMPE: Yes.

MS. BERNHOFT: Nobody disagrees with that.

MEMBER REMPE: Interesting.

MS. BERNHOFT: Yes, it's interesting information.

DR. SHACK: Just coming back to Joy's question again. When it says slow neutrons, that means that flux level that's plotted up there is for neutrons way down in energy? When it says fast it's everything above .1 MeV?

MS. BERNHOFT: Yes. And we had a lot of discussions too about, you know, what to put on. As Tom said, you know, we got into kind of some diminishing returns on the data that we had available.

DR. SHACK: So, I mean, that scatters even more?

MS. BERNHOFT: It could be. And some data points we took off. I mean, we did filter the data somewhat that we got from some of the original Hilsdorf data. And some of the two, like you said, the aggregate types were just so unrepresentative, you know.

There were actually some points that never hit the knee of the curve. And when we went out and looked at those, those are actually more of a glass type aggregate too. So we just took those off the curve.

MEMBER RICCARDELLA: Any plans to harvest any of this kind of data from existing plants, shut down plants?

MS. BERNHOFT: DoE is, I think, attempting to harvest some concrete from Zion. I don't know if you're going to be talking about that.

MR. ROSSEEL: Yes. I'll talk about that a little bit later. But we're trying to obtain materials, cores from the Zion plant. We're in the process of doing that. We hope to get some in the next few months, if it's feasible with their schedule.

We've also initiated discussions with Barceback to obtain cores from their reactor. We've talked to Zorita as well. We'd like to talk to Crummel. We haven't been able to engage them yet. But we hope to do that. And I'll try and explain how we're going about that process.

MS. BERNHOFT: Thanks. Okay. So we do have an integrated road map with DoE. We're working on alkali silica reaction. One of the things we're doing is, we have developed a map across the United States, looking at where we think some of the, where the high risk aggregates came from.

Looking at the testing methods for the plants to us, to test how much ASR that they have, so they can start setting up their possible susceptibilities. And LWRS has taken the lead on doing some of the mechanistic modeling, and the structural integrity from that.

We talked about this, the need for the irradiation testing. The fact about how, when you're doing the radiation testing, how you account for what's the gamma heating, how you account for what's the radiation affects. And how possibly you need to look at either bifurcating or combining those two affects.

And so we've completed the literature search. And we're looking at going into more of thermal and the accelerated radiation testing this year. Those are some of the things we're looking at. Creep fatigue.

We're working with the department, looking at the database from the Department of Transportation, and how that can possibly apply to the nuclear power plant civil structures. The boric acid impacts. Like I said we're in Review 2 of that project right now.

Working with CEA in France, doing the mechanistic models of the boric acid tack on the concrete and the rebar structures.

And for our members, we're going to be developing an overall toolbox for concrete, and concrete structure repairs. Some of the things we talked about that I didn't put on the overheads, because they're not into the Aging Management Programs.

We're also doing quite a bit of work in support of like the dry cast storage containers and the aging of the concrete on those. In the few minutes I have left, and I appreciate the time, I just want to give a couple of quick examples on how you handle a Category 2. So these are the Category 1 Aging Management Programs.

And again, what I want to say is, you know, we agree. You can see from what the data shows that there are areas that we, you know, want to continue the research. But we have a lot of information. We have the programs. We have the research in place, you know.

We've also set up how we're going to prioritize that research. Like I said, we agree, internals, we want to keep working on that. Concrete, let's make sure we're doing the right things before we go in and start doing some of the concrete, you know, radiation testing. It needs to be done. It might not be quite the highest priority.

What we need to do right now is, it's in a limited talent of the resources that we have. So a couple, these are just a couple of examples I pulled of some of the Category 2 Aging Management Programs.

Steam generators, we've already talked quite a bit about the buried pipe flow accelerated corrosion, and the water chemistry. And these are the programs, we totally agree that they're aging. They need attention. They need management.

So we have established programs in place that will continue to do what they're doing in these Aging Management areas. A steam generator program is actually required by a plant's technical specification. We have the steam generator management program, it's a large international program.

We have an NEI document out there. You can see several of the reports that help the plants with implementation of their steam generator management program. And also under their tech specs there are reporting criteria and requirements, if they find anything coming out of their steam generator inspections.

Buried pipe, we talked about that. This is covered under an NEI initiative. Utilities have been implementing this. The programs are in place. With that, we are continuing to do research. But the research is focused more on advancements in the section methodologies.

It's, you know, it's not, there's a lot of miles of pipe to inspect. So we're trying to work on automated inspection methodologies. And we're working on some better repair and replacement. We're looking at like, particularly HDPE piping as a replacement. Flow accelerated corrosion. This is also covered under, primarily under NRC Generic Letter 89-08.

And we have programmatic guidance in some of the EPRI reports. And this is also a program that INPO looks at when they come in. Again, it's a very mature program, a lot of experience. We have the database through the CHUG workers group. Work we continue to do is program optimization.

And again, inspections are ways that we can improve the inspection methodology and the feedback. And then our water chemistry programs. Again, these are all actually under NEI 03-08. And or goals are, of course, material integrity and corrosion. That's our Number 1 goal.

Then fuel integrity, radiation control, and of course, plant specific optimization. But we base these guidelines on Operating Experience. We also have large U.S. and international input on to these. And we do quite a bit of inspection results.

And we're always working to do continuous improvement in these programs. They're updated routinely, based on what we find from inspections, R&D and Operating Experience. And will continue to be.

So in summary, based on the tools that are provided from the EPRI research, there is, you know, robust background for the Aging Management, between the R&D to understand the degradation, the inspection methodologies, mitigation strategies.

How you do condition monitoring, working on the tools, and the algorithms and software to predict remaining existing life. And always, you know, we always look at also, you know, what could be the repair or replacement decisions that we need to provide for these facilities.

CHAIRMAN SKILLMAN: Sherry, thank you very much. What I really heard you just do is, identify the 50, went out to the eight. And you just explained in detail those eight AMPs that, at least in EPRI's judgment, constitute the highest risk at this point in time.

MS. BERNHOFT: No, the highest priority for research.

CHAIRMAN SKILLMAN: The highest priority for research. Thank you. Let me just pause for my colleagues. Any questions around the table here?

MS. BERNHOFT: And hopefully gave you some feel for the wealth or research that exists in those areas.

CHAIRMAN SKILLMAN: Sherry, thank you. I'm going to ask for a ten minute break.

MS. BERNHOFT: I think Mirela has a question.

DR. GAVRILAS: It's not a question. I just want, this is Mirela Gavrilas of the staff. I just wanted to answer Dr. Shack's question regarding the accelerated testing. We actually have a program now where we're doing samples on Halden, and radiated to 0.5 degree DPA.

And we're irradiating exactly the same

material in the ATR, within the same range, to see what the accelerated, what the flux rate and the spectrum ATR does, in terms of introducing atypicalities.

DR. SHACK: Okay. But you're not going to get to 100 DPA in the ATR.

DR. GAVRILAS: I was going to say that you have to wait 15 years for us to tell you the answer to the 58 DPA.

DR. SHACK: But the 100 DPA I assume is being done in a fast reactor, somewhere in Russia.

MEMBER STETKAR: The HFIR, or something that --

DR. GAVRILAS: No plans along those lines yet.

DR. SHACK: You said 100 DPA, right?

MS. BERNHOFT: The one project that we pulled, we actually did is, we took some thimble tubes, which get a high radiation exposure out of a reactor. And we fabricated samples out of those.

MR. SHACK: Oh, okay. That's where your high fluence -- Okay. That's nice, actually.

MS. BERNHOFT: Yes.

CHAIRMAN SKILLMAN: Thank you, colleagues. Any other questions? I'm going to call for a ten minute break. Please, reconvene at half past four, 1630 on that clock. Thank you.

(Whereupon, the meeting in the above-entitled matter went off the record at 4:19 p.m. and back on the record at 4:30 p.m.)

CHAIRMAN SKILLMAN: We're back in session. Good afternoon. Richard and Tom, welcome. We look forward to your presentations. Please proceed.

MR. REISTER: Thank you, Mr. Chairman. My name's Richard Reister. I'm a program manager for the Department of Energy's Light Water Reactor Sustainability Program. And I'm going to give a very brief overview of our program. And then I'm going to turn it over to Tom to cover the details of our materials research, which I think this committee is mostly interested in.

The objectives of Light Water Reactor Sustainability Program is to develop technologies, and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors. So we're about supporting the long term operation of the existing fleet where it's centered around license renewal.

But the long term operation, which really comes down to economic issues, as was mentioned earlier today. So the program goals, develop -- And I think as Sherry outlined very well, you know, we're focused on the scientific basis to understand, predict and measure the changes in materials.

And EPRI focuses more on their applied research. So we're more the basic research. And so we're going to apply this knowledge to develop and demonstrate methods and technologies that can support the long term operation of the existing fleet. We're also looking at new technologies to address and enhance plant performance, economics and safety.

So again, we're not all about license renewal, or a licensing process, but the long term economic viability of these plants. As you can see, we have a program plan, a detailed program plan. We also have a joint research plan with EPRI. These plans are available on our website.

And actually, each of our technology areas, which I'll be discussing, has their own detailed program plans. And these are also available, publicly available on our website, if you need some sleeping material. This is just a very brief outline of how we're organized.

The main points I want to make is, we have the three technical research areas, which I'll highlight very briefly. We do have an industry advisory committee, that's given us good advice on making sure we're headed in the right direction. And as was mentioned, we're very closely integrated with EPRI's long term operations program.

And we coordinate very closely with NRC's Subsequent License Renewal program. And we also try to coordinate internationally as well, to make sure we have, you know, the big picture on where the research should be going. We are coordinated through our national lab system by having a technical integration office.

And Kathy McCarthy is here. She's the head of our technical integrating office that's out at Idaho National Lab. The materials research is done through our Oak Ridge National Laboratory. And that is actually the largest. More than 50 percent of our program is really in the materials research area.

The two other areas are on advanced instrumentation and controls, and risk informed safety margin characterization, are led from, out of Idaho National Laboratory. So first I'm going to cover the two areas that I think you're probably not, or as interested in. And then we'll cover the materials research, and I'll turn it over to Tom.

The first one is the instrumentation information and controls. And this is looking at the long term aging of our INC systems. And we see that, you know, especially when you look at going from 60 to 80 years, these plants need to modernize to stay viable, economically viable.

And just the systems, the analog systems are not going to be able to be maintained. And we're talking about 30, 40 years from today. So we're working with industry, primarily through pilot plant projects at plants, to demonstrate how you would move instrumentation and control systems.

And it's not all about the control room. We're talking about all the control systems in a plant. Moving them from the current mostly analog based technology, to digital systems, the current modern technology.

We think there are a lot of improvements, both safety improvements and economic improvements that can be realized at these plants. And so we've made some good progress in this area.

CHAIRMAN SKILLMAN: Before you change that slide, Richard, let me speak for myself. I see change in the INC systems as critical to this discussion. While EPRI just showed us eight programs that require more research, maybe in a different vein, changing from analog to digital, and making sure that the new digital meets new standards, as we are saying for the new designed, will be a critical part of this.

Because the analog systems won't make it. They're dying. The analog systems don't have parts. And so, I think around this table there will others who will echo my comment that, we do see the INC systems as a very critical piece of what we are talking about. So I don't want that to be lost in your comments. We get it. We understand how important it is.

MR. REISTER: All right. So we're working with industry again to try and find ways to move the ball forward in incremental ways. It's a big problem to take on all at once. And so we think the right way to do it is to find areas where we can move forward. Find some success, and get some momentum behind modernizing these plants.

CHAIRMAN SKILLMAN: Oh, we're seeing digital upgrades. We know it's occurring. We know the bases for these upgrades. So it's not a stretch to see that that will be something that is important for the future. John.

MEMBER STETKAR: Richard, in this area though, you mentioned that you're looking at this out in real plants. Those are all distributed, focused digital control? It's like a digital feedwater control? Or a digital, I don't care, turbine control? Or a digital, help me out.

MR. REISTER: Well, we have a whole suite of --

MEMBER STETKAR: I guess my question is, where are you looking at the fully integrated protection control systems? Or are you?

MR. REISTER: We are looking at that. And we have, we actually built a simulator in Idaho that can replicate on glass panels an analog control room. And then it can also start implementing digital controls in combination with analog.

Because we think, for the most part, it will probably end up being a hybrid control system, where you have some digital and some analog. At least talking to the utilities, we don't see a very high likelihood that they will do a wholesale replacement of their control room, for example.

So there will be some mix, at least for some period of time, with analog and digital systems. And so you need to be able to understand how you can do that hybrid, I'll call it, control room technology. And so this simulation environment enables you to look at those types of changes.

So we are looking at the future vision for what a modernized plant would look like. Because you don't want to, you want to move with that vision in mind as you modernize the plant.

But we don't really see right now a very high likelihood that they would rip out the entire control room, basically replace it with what you would see at an AP 1000 now, which is basically computer screens, right? We don't really see that happening at the older plants. I could be proven wrong. But we don't see it right now. That would be part of what --

MEMBER STETKAR: Have you looked at what's been done internationally?

MR. REISTER: I understand that.

MEMBER STETKAR: Okay.

MR. REISTER: But it took, you know, a multi month outage to accomplish that.

MEMBER STETKAR: But somehow people justified the cost of doing it.

MR. REISTER: In a plant that was essentially owned by the Government, or a monopoly electrical system. But anyway --

CHAIRMAN SKILLMAN: Let's proceed.

MR. REISTER: Another area is the, we call the risk informed safety margin characterization. And this is looking at advanced methods to understand this safety margin in a plant. So as the plants age, as changes are made, this is a methodology to understand those, the safety margin.

And the methodology is really looking at a simulation based analysis tool, where you have a high fidelity plant simulation model. And then you run a scenario through that model, that simulation model. But what happens during that simulation is driven by probability. So you run that model many times, maybe thousands of times through that simulation model.

And you can get a probability distribution for the outcome of that scenario that you're looking at. And then you can understand, not just in a point way, you know, whether you were safe or not for a particular scenario.

But how close are you to your safety limits? And if you made changes, if you had different reliability for equipment, of if the plant ages, you can understand how those safety margins, that probability distribution is changing with the different scenarios that you might be looking at.

This methodology has been well understood. But the problem is, they didn't have enough modern tools to make it practical to do this type of an analysis. And so we're developing the tools to make this methodology more viable.

RELAP-7 is a modern version of RELAP-5. It's not because we thought RELAP-5 couldn't do its job for what it's focused on. But RELAP-7 can do a better job for a much wider range of scenarios, and much easier. It's a modern tool that can be changed much more easily, and maintained for this type of analysis.

RAVEN is the simulation controller. It's what drives the scenario. It's what controls the, allows the operator to define the parameters for the scenario they're looking at. It also does a lot of the probabilistic type analysis.

And then we're also developing an aging simulation, which we call Grizzly. But it's a component aging model. And so this touches on a lot of the things, a lot of the issues that were raised this morning, related to the risk analysis. But it's a tool that can move us, we believe, in the right direction, in terms of modern capability.

And there are other areas that nuclear energy is working on. Not part of my program, but in the modern safety analysis tools like Castle, for looking at the reactor core and very high fidelity through our NEMS program, Nuclear Energy Modern Simulation program.

Looking at some other advanced modeling tools. So there's a lot of work in the modeling area. And we're hoping to bring it to bear on this issue of long term operations.

MEMBER BLEY: Is this going on at Bonneville in particular or is it spread out?

MR. REISTER: Well, it's led by Idaho National Laboratory. But a lot of other labs are involved in the work. So with that, I'll move toward materials research. And again, this is the largest area.

And I think as you all are aware, you know, as these plants age there's additional time at high temperatures, stress, coolant chemistry, environments and neutrons, all leading to materials that are susceptible, that have a higher susceptibility and severity of known forms of degradation. And in addition, there could be new forms of degradation that we haven't seen yet.

So we're trying to develop the scientific basis for understanding and predicting these long term degradation behaviors for materials unique to nuclear power plants.

So we've talked about concrete. We're looking at concrete in the unique nuclear environment. So there's a lot of data outside of the nuclear area. And saying we're using these data and methods to assess the performance of these systems to support the safe operation of the plant.

When we look at our particular materials degradation area, we're looking at it in various dimensions. One, the first we look at is the measurements of degradation. So it's important to have high quality data. We can collect a lot of data.

In particular if you collect data, I think it was mentioned this morning, collecting materials from different plants. If you don't really understand the environment that the material was in, the history of that material, the data you get can probably not be very valuable. So it's important to get high quality data to really understand what's occurring to the materials degradation.

And so with this, and high quality data can be valuable, you know, by itself. And we're trying to use this data to develop mechanisms of degradation. So we're really trying to understand the fundamental modes of degradation that are occurring.

So again, this gets back to the basic science area. And so, if we can better understand the methods, mechanisms of the degradation, then we can develop models that can model that degradation, particularly if you're trying to look in the future.

So you mentioned high fluence affects. If you really understand the degradation of the material, the mechanisms of the degradation, and you can model it, then you can predict how that material would behave at higher fluences.

And then, of course, we have to monitor that to validate those models at the higher fluence, both with models, model materials where we can test in a lab, representative materials that are tested in a lab environment. But also collecting samples from operating plants that we can again validate that our models are accurately predicting how the material's really behaving in a real world environment.

And then finally, we have mitigation strategies. We're trying to understand how we can apply, or correct. Either prevent the degradation in the first place, repair, or replace components. So this is my last slide. But it's really just a summary of the areas that we're focusing on in terms of materials.

Reactor metals is a typical area that we looked at. Mechanisms of irradiated assistance, stress growth in cracking, the high fluence effects on reactor pressure vessel steels, the thermal shock issue. And crack initiation of nickel based alloys, which is really for internals.

And we have, kind of the new areas are concrete and cables, in terms of the focus areas for Subsequent License Renewal. And I think Sherry did a good job of discussing how we're closely coordinated with industry in joint research plans to address both concrete and cable aging.

And I would also say that we try to work very closely with the Nuclear Regulatory Commission to include them in our research, so that they can at least -- Maybe they're not doing the research themselves, but they're understanding what we're doing and how we're collecting the data, so that they understand and can provide input if they feel that something needs to be done in terms of our research priorities and directions.

And then finally, as I mentioned, there are mitigation repair and replacement technologies. Some particular areas we're working on is welding repair techniques, in particular welding repair for highly irradiated materials. So for example, if you wanted to repair core internals, how you could do that successfully.

We've talked about post irradiation annealing, like reactor pressure vessel annealing. But we're not doing a lot of work in that area yet, until it becomes more of a likelihood that someone would actually move in that direction. Or that they would need to, and consider doing that.

And we're also looking at advanced replacement alloys. If you did have to replace a component, you might be able to replace it with something better than what we currently have today.

And with that, unless you have any questions for me, I'm going to turn it over to my expert, Tom, from Oak Ridge, who's going to cover the materials research in more detail.

CHAIRMAN SKILLMAN: Can we just pause? Colleagues, any questions for Richard. Tom, please proceed.

MR. ROSSEEL: Okay. I have way too many slides. So I'm going to try and go through these at a reasonably good clip. And, like I said, if the Chairman would give me a five minute warning, it would help me.

CHAIRMAN SKILLMAN: I will do that. Thank you, Tom.

MR. ROSSEEL: I'm speaking on behalf of Jeremy Busby, who is the pathway lead. Jeremy is in the Czech Republic. He's in Prague. He's attending a meeting on environmentally assisted corrosion. That's a interaction between specialists that share information pre-publication. I believe the NRC is also a participant in that as well.

So let me give you a quick outline of my presentation. I'm going to talk a little bit about the pathway. And I've got some slides that Rich has already shown you. So I'll just skip over those, then talk about the key activities within the materials aging and degradation pathway.

A little bit about partnerships, which is an important part of our pathway. And then some examples of research. This is not going to be a comprehensive overview. I cannot cover everything in depth, because it would take hours. So I'm going to talk a little bit about concrete, cables, metals, weld repair, and integrated research.

Basically Zion, because that's something that I'm involved with, harvesting materials. So this is a slide that Rich has already shown you. I think the only thing that I want to point out is, of course, at 60 to 80 years the severity of some degradation should get worse.

But we also expect to -- I lost my pointer someplace. There it is. New mechanisms of degradation, sometimes called the unknown unknowns. And what that of course leads us to is to perform a gap analysis. And that gap analysis is what Mirela talked about earlier today, which is the EMDA process.

And, of course, it's based on the PMDA, which was, I think work was done in 2003 through 2005. I guess the NUREG report 6923 was published in 2007. And the idea behind that is that you're asking panelists to basically evaluate the susceptibility, as they see it, of the likelihood of degradation, versus the knowledge.

And then there's actually a third dimension, which is their confidence in their assessment. And in terms of concrete they actually came up with a fourth dimension, which had to do with how important that particular affect was, according to their assessment.

So again, I'm not going to spend a lot of time talking about this, other than the fact that, of course, pressure vessels, concrete and cables are new. The core internals and primary piping was covered under 6923 for 60 years. The core internals and primary piping for 60 to 80 years is what's covered in the EMDA report, Volume 1 or 2, whatever it might be.

And this is just a slide to point out actually, I think we counted five volumes, because it included an overview. And again, I'm not to spend any time talking about this, because I think you've heard enough earlier today. This is kind of a picture of all the things that we're involved with.

I think we have 20 separate tasks within the materials aging and degradation pathway. We're involved with concrete degradation and NDE of concrete. High fluence affects on reactor pressure vessels, as well as NDE of the reactor pressure vessels, analysis of cable degradation, as well as NDE of cables.

The NDE tasks are all fairly new. So we don't have a lot of new results. We're in the process of developing those areas of interest. Mechanisms of irradiated assisted stress corrosion cracking, crack initiation. I think I have one slide on that for nickel based alloys.

Swelling of core internals, high fluence based transformations. I believe I have a slide on that. Environmental fatigue, I don't think I have anything today on that. CASS, stainless steel aging, nothing on that today.

High fluence irradiated assisted stress corrosion cracking, surrogate materials and attenuation, those are issues dealing with mitigation, as well as what happens when you run out of materials that you had in your surveillance capsules originally. Can you find other materials that you can either put back in? And I think that's been addressed a little bit by Sherry. And I think Mirela might have mentioned something as well.

We switched to green color to show mitigations to repair welding, thermal annealing. And it was pointed out the Russians have done this. And this is something that Oak Ridge National Laboratory was involved with, through the heavy section steel irradiation program, which Ted Hackett is very familiar with.

Back in the '90s we talked about it, but funding became short. And we have some preliminary results. But I'm not going to talk about that today. And I think as Rich mentioned, advanced replacement alloys. And again, we have about 20 tasks within the program, within the materials pathway.

I don't have time to talk about those all today. I'm only going to just show you this slide one more time. You've seen this with Rich. I'm not going to go through all the details. But when you look at this again sometime in your leisure you'll see, this is the model that Jeremy has instilled into each of our tasks.

So we look at degradation, excuse me, collecting data, mechanisms, modeling, monitoring and mitigation strategies. That's the thought process that we're working on on all of our tasks. So let me just skip through that.

This is a chart of the partnerships that we have. As Rich pointed out, the program is, the TIO office is at Idaho National Laboratory. We put the DoE National Laboratories at the center of this. But we work closely with the nuclear industry. We have a MOU with EPRI. We have a joint research R&D plan with EPRI.

We're involved with industry pilot projects. We work with a number of universities, Michigan, Missouri, MIT, Santa Barbara. We interact with some of the DoE user facilities HFIR, ATR, Castle, the Consortium on Advanced Simulation of Light Water Reactors.

We have an MOU with the U.S. Nuclear Regulatory Commission. We have partnerships with Halden Reactor Project, as well as Materials Aging Institute. Work is being done not only at Idaho and Oak Ridge, but Pacific Northwest, Sandia and Argonne. I think I've got them all.

CHAIRMAN SKILLMAN: Brookhaven.

MR. ROSSEEL: Brookhaven's not on here, and it should be. Old slide. All right. So I'm going to transition now to some of the work we're doing, just some of the tasks we're involved with. And start out with concrete and civil structures.

This was work actually, I think, that started with the NRC. This is the nuclear concrete materials database. It's been completed. And it's been populated for aging, elevated temperature, irradiation and migration of hostile species. I won't spend much time talking about that. That report is done.

I think there's the ORNL/TM-2011/296. And then we'll talk a little bit more about concrete and irradiated concrete. And as I was telling Joy, I actually yanked about four or five of my slides, because I thought way too much detail. But based on the questions earlier, maybe that was a mistake.

But I'm going to talk a little bit about how we developed the road map for this multi path strategy for addressing irradiated concrete issues. And then talk a little bit about something that I just participated in. And this was the organization of an international irradiated concrete information exchange meeting.

This is similar to what Jeremy is attending on the environmentally assisted corrosion. It's very similar to the IGRDM, which is their international group on irradiation damage mechanisms. The idea is to share data pre-publication, so that the researchers in the field can advance it more rapidly.

And as you can understand, with the issues of trying to get to Subsequent License Renewal, it certainly would be more helpful, since irradiation of concrete or reactor pressure vessel material takes time. So you need to move the field as quickly as possible. So we put this together.

We've gone through preliminary stages. And we now have a new group called the International Committee on Irradiated Concrete. And it's modeled after the IGRDM model. And that was last month in Barcelona that we did that.

This is the Hilsdorf curve. And let me just explain this in a little more detail than we've talked about before. A lot of this work was probably done, maybe even in the '50s, '60s and '70s. The specimens were not the typical concrete cores that you'd like to look at. They were cubed specimens.

Usually with concrete cores you want the diameter to be twice the size of the aggregate. Typically the length of the core to be twice the size of the diameter. So there really weren't ideal concrete core specimens to be looking at.

The temperatures typically were done in a reactor that should be at 65 degrees C, not to exceed maybe 93 degrees C. In these materials it could be as high at 200 degrees. Some of them were done in water. A lot of strange things were going on. But basically, from these critical levels and codes, were placed into codes.

And based on this experimental data collected by Professor Hilsdorf, Kropp and Kock, excuse me, back in 1978. And you can see they came up with a cutoff energy, a reference energy of one times ten to the 20th.

And generally it was thought that they were talking about energies greater than .1 MeV. And then for gamma rays, referenced those at two times ten to the 10th rads, or two times ten to the 8th rays.

MEMBER REMPE: Before you leave this slide --

MR. ROSSEEL: Sure.

MEMBER REMPE: Could you go back? Why does it say liquid glass? That's something that wasn't on the slide that we saw earlier.

MR. ROSSEEL: Yes. That's actually what it turns out that material was. It was, just to show you that there was a lot of strange things that were in there, and that they were radiated. But I will show you one in which you will see that there actually is a knee to this curve.

And I will show you some, a little bit additional data. But this is what most people kind of look at and say, okay this is -- There are a lot of strange things here. It's a little unusual. And you can see that the neutron fluence cutoff energy, not well known.

And certainly one of the things we're interested in is trying to develop sort of a DPA model, rather than saying, well, fast neutrons. But what does a fast neutron mean? Is it 1 MeV? Is it .1 MeV? Is it anything greater than thermal?

How much does it depend upon the spectrum? What is the composition of the concrete? Concrete, we like to say, is one of the most complex materials around. Everybody, I think it's been around since the Roman times. But it's extremely complex. It's a complex composite.

What was the irradiation temperature? What was the gamma ray dose? Were some of the gamma rays shielded? Or what was the temperature? Is there any model to understand how radiation affects concrete? So what we think is important is, certainly more data is needed under control conditions.

A better understanding, and control the variables. And a robust understanding of the affects of irradiation. And we don't feel that that is there right now. But something we're working on.

Back in the fall of 2013, with EPRI we developed a road map. And I won't go through it in great detail. But there is a, the X axis is the timeline. We have knowledge of degradation mechanisms, assessing and managing the degradation rate. And safety margin assessments and structural significance.

This is, the gray color is prior or existing knowledge. In the orange, this basically relates to work that's been done by the Japanese. They've got quite a lead on us. It's the Japanese Aging Management Program for Structures and Systems.

They've been working on this for a number of years, and are currently, they've completed some gamma radiation studies. They're doing some neutron studies at Halden. In addition, Fortem is also doing some irradiation studies at Halden as well.

We're planning some irradiation studies. We'll be doing some of that with EPRI. That's why this color I was trying to indicate is, and I think I'm running out of time here very quickly. Let me go on to --

Having a road map is one thing. But trying to develop a strategy that actually works is something that's more important. So one of the things we've been doing is trying to characterize the radiation fields in concrete structures. Determining the bounding values. That's something that Sherry has shown you.

We've been working with EPRI on that. We'd like to obtain more data that involves both irradiating prototypical concrete to levels equal to or greater than the expected extended service. There are some issues with accelerated irradiation in terms of whether there are any rate affects.

We'd like to harvest and test irradiated concrete from decommissioned plants, both in U.S. and in international. And I mentioned Barceback and Zorita, as well Zion in the United States. Trying to develop a more robust fundamental understanding of the affects of irradiation on concrete.

And then establish a collaborative research with international partners. And that's one of the things I mentioned with the meeting that we had in Barcelona. So this is a valuable curve to look at.

This is the neutron flux profile. I think this was for the H.B. Robinson 2. And the black curve is the thermal neutrons. The orange or red is the total neutron flux. The light blue, or the blue, is greater than .1 MeV. And the green is greater than 1 MeV.

And you can see as you go through the concrete, the attenuation is different for different energies. You can also probably look at this in terms of the scale. And you can see in the first ten centimeters, the attenuation is pretty sharp.

So if there is irradiation damage in concrete, it's going to happen in the first four inches of the concrete. Whether that has any structural significance is debatable. But that's pretty much what it looks like at this particular stage, when you're talking about potentially 80 years of operation.

MEMBER RICCARDELLA: Is that analysis or data?

MR. ROSSEEL: This is analysis based on

data. This is another way to look at the curve, the information that Sherry showed you for -- The red is neutron fluence for the entire spectrum. Blue for greater than .1 MeV, and green greater than 1 MeV.

And you can see that the 1 MeV neutron's really not likely that you'll see much of an affect to get to ten to the 19th or higher. And this is the curve, Joy, that I wanted to show you, you mentioned earlier. This is a more comprehensive look at some of the literature data.

And you can see that there is definitely a knee. But you can see, this is where the two loop plant at 40 years, two loop at 60 and two loop at 80. So there's just the beginning of an effect here. And if you look at the colors, it turns out that the type of aggregate that you look at is very important in this process.

And as it turns out, quartz is a very important player in this. The more quartz you have, the more likely you're going to see some sort of affect. So those plants that have quartz were more likely to see degradation.

And again, even though they see some degradation, it does not necessarily mean that there's going to be any critical affect on the operation of the plant. It just means that they're, the concrete can suffer some degradation, at least in the four inches or so of the, for example, the biologic shield. All right. So if you, I don't know if you need to ask me any questions about irradiated concrete now, or if I should go on?

CHAIRMAN SKILLMAN: Colleagues, any questions? It almost seems counterintuitive, with the higher percentages of quartz, the reduction that you see in the compressive strength, when vitrification seemed to be the path forward for waste.

And maybe compressive strength doesn't have any play with vitrification. But it seems that, you know, for a while there we were saying vitrification is a way to take care of waste.

MR. ROSSEEL: Right.

CHAIRMAN SKILLMAN: And quartz is a very important piece of glass.

MR. ROSSEEL: Well, when quartz is irradiated and it becomes amorphized it has a tendency to swell. And we believe that radiation induced volumetric expansion of the quartz is the thing that will cause the cracking and loss of compressive strength in the concrete.

CHAIRMAN SKILLMAN: Thank you.

MR. ROSSEEL: Another we're looking at is NDE. We're looking at it for concrete, cables, fatigue damage, reactor pressure vessels. And this is just a picture of some, there it is. This is a 3D cut of some rebar and post tensioning cables. This is at three to, if I can read that, three to six inches. And this is from six to eight inches.

You can see when you look at it in different slices, you see different things on the, using this ground penetrating radar. Recently with ORNL, with the University of Minnesota, and engineering and software consultants, they tested a variety of ultrasonic detection, NDE techniques.

And specimens included rebars, flaws that were put into the specimens. And what we found was that a lot of these different techniques need to be evaluated. Some have strengths, some have weaknesses. But perhaps advanced signal processing techniques may be the most important thing.

And you can that the original ultrasonic data is shown on the right over here. And then on the left you can see a little bit better as to where the voids are, and the rebars. So that's with post processing. So as the technology improves with NDE and ultrasonic detection methods, I think we'll see a lot better data, and a lot more ways of monitoring concrete.

MEMBER REMPE: So I'm a little slow on the questions here.

MR. ROSSEEL: I'm sorry.

MEMBER REMPE: But if we go back to 17. The ones that are the diamonds, that are -- Is that river rock, is what that is?

MR. ROSSEEL: Yes.

MEMBER REMPE: There on the far right?

MR. ROSSEEL: Yes, yes.

MEMBER REMPE: And it's showing -- What temperature was it at? I mean, the quartz thing was at 500 C on that other plot, right? Was this at a different temperature?

MR. ROSSEEL: I thought that was at 200 C. But I guess I'd have to take a look at it.

MEMBER REMPE: Your thing I think said 500 on that plot.

MR. ROSSEEL: It might, yes. Okay.

MEMBER REMPE: But, I mean, there is a temperature affect too. And is that shown on some of your plots somewhere too?

MR. ROSSEEL: I don't think this was corrected for temperature.

MEMBER REMPE: Would that make it stronger, if -- Well maybe river rock is at low temperature, right? So, I mean, I guess, it seems like there's a lot of affects. And perhaps we don't know all of --

MR. ROSSEEL: That's correct. That's why we want --

MEMBER REMPE: And it's just a lot of uncertainty.

MR. ROSSEEL: That's why we need to collect more data. We believe that it's important to irradiate prototypical concrete. And one of the things I had some slides on is a little bit about modeling. And we do have a model on that, a preliminary model, as well. But again, we need more data to be able to make sure that the model really works.

MEMBER REMPE: Of course, again, it's two loops in 80 years are the ones that, I guess, are thinking may have the worse case scenario.

MR. ROSSEEL: Right.

MEMBER REMPE: But where would like a four loop, how far down would it be? I've forgotten now from the -- Is it going to be ten to the 18th instead, or something?

MR. ROSSEEL: Let's see.

MEMBER REMPE: There's a three loop.

MR. ROSSEEL: There's a three loop. I don't think I have a -- Three loop is it.

MEMBER REMPE: So it still can get up there?

MR. ROSSEEL: Yes. That's the integrated. But we don't really know what the --

MEMBER REMPE: Okay.

MR. ROSSEEL: -- how to evaluate that at this point. Cable insulation. All right. This work is being done at Sandia National Laboratory. This is gamma irradiation at the LICA Facility, the low intensity cobalt array.

And there's some initial data. I think they had some problems with their facility. But it's back in operation. And I will show you a little bit about accelerated aging of real cables. This is cables that were taken from the high flex isotope reactor.

And there was some tensile data at varying times and temperatures that were taken. And I can see that it would be a whole lot easier to look at this if we had drawn lines to these various plots of different temperatures.

But from that we were able to superimpose the data, using activation energy of 79 kilojoules per mole. And from that come up with a curve which we can plot tensile elongation versus time and hours at 90 degrees C. And under those conditions we find that the cable at HFIR could last as long as about 300 years.

But this is just a preliminary look at doing this. We haven't applied it to any other existing cables from plants. But this is just one example of what was done with the HFIR cables.

We were able to get these and send these over to Sandia. And like I said, those cables were about 45 years in age, and typically operated at 27 degrees C, and the relative humidity of 70 percent.

A little bit about reactor pressure vessels. I think this has to deal with late blooming phases. I think it was just mentioned briefly, earlier this morning. It's well known that copper rich welds have hardening issues. It causes embrittlement of the reactor pressure vessel.

Modern reactor pressure vessels have lower residual copper levels. However, as it turns out, irradiation made dry phase transformations, even in low copper alloys. This is the so called late blooming phases. They're typically composed of manganese, nickel, also silicon, copper materials.

And as it turns out, these do seem to show up in different materials earlier than perhaps previously anticipated. This is an example over here on the right. This is the, I think it comes from Ringhals Unit 4. This is low copper material. And this is from the surveillance capsules.

You can see that at higher lead times it looks like you see a fairly large shift in the transition temperature. And you can see it using an atom probe, that you start to see these precipitates, which are where you're going to get hardening. They're rich in nickel, manganese, copper and silicon.

And then I'm going to show you another one, where this is the Ringhals Unit 3, and a series of atom maps at one nanometer slices. And what the first on is, I believe that is in blue, so that's manganese rich, copper rich, silicon and nickel. And I guess, oops, I missed, excuse me, that one is phosphorous, and that's nickel.

And this is an example of what you're looking at using an atom probe. You can see what the atoms are.

So these are not just necessarily just the typical copper rich precipitates that you see when you're thinking about looking at copper welds, copper heavy welds. But these are fairly low copper, .08 percent. High nickel, high manganese, higher than in a U.S. plant, both the nickel and the manganese.

But we can see that we do get a fair amount of embrittlement with these materials. And basically validating that late blooming phases can be an issue at higher fluence. Obviously it's accentuated by the fact that we're looking at high manganese and high nickel, which are not as typical in U.S. plants

But this is something that certainly is a concern. This is something that we did kind of merging a little bit of the RPV work with Grizzly, which Rich had mentioned from the RSMIC pathway, to calculate changes in temperature, and transition shift over time and location. Basically, taking data from 40 years, and then extrapolating it using the Grizzly aging program.

And this is just a model. It's not real, anything more than just an example of what can be done. This would be at 32 years of operation, 60 years and 80 years, where the temperature shift is larger. And of course, this is near the core region.

And just showing that we're incorporating this. We'll be incorporated welds in heat affected zones, spatial variations and chemistry, and vessel cladding. This is a collaboration between Idaho, Oak Ridge and UT, okay, in Knoxville.

Radiation affects. Just briefly, this is just some high fluence data on some core internals. And from these we were looking at, this is some TEM, looking at coherent precipitates, incoherent precipitates and phase transformations.

The researchers are beginning to be able to develop models that can predict a little bit more about what the damage mechanism will be. And this is an example of some work that we're doing with Areva and EPRI. It has to do with, we're doing the post irradiation evaluation of some embrittlement of nickel based alloys.

I can't explain a whole lot more about it. Because there's some proprietary work with Areva that's been involved with this. But what they're trying to do is, from this data be able to develop mechanisms to explain the nickel based alloy cracking. And I'm going to skip the corrosion, because we're, I guess --

CHAIRMAN SKILLMAN: You've got ten minutes, Tom.

MR. ROSSEEL: All right. And then on the, let's see, the corrosion material. This is something, this is a new area that we've been starting. This has to do with some work being done at PNNL on stress corrosion cracking initiation testing, where the alloys have received different surface treatments.

And they're able to look at 30 tensile specs, and the simultaneously, using mill-annealed alloy 600 under different cold working conditions, and studying the crack nucleation that was detected. And again, the idea is, this is a new pathway. But this is an important area that needs to be addressed

And then, in terms of mitigation. I think Sherry mentioned this earlier. This is a joint project between the Light Water Reactor Sustainability Program and EPRI. And it involves basically using finite element analysis to assess the stress at different temperatures. And then being able to try and control both the stress and the temperature field.

And using advanced welding technology such as hybrid lasers, friction stir welding and other techniques. And I'll show you, I think this one shows a little bit more about what they're trying to do in terms of doing this in a hot cell. This is a first of its kind in the United States. We can use different, laser welding, arc welding and friction stir welding.

And again, the idea is to be able to monitor and control the temperature and stress, or excuse me, monitor the temperature and stress. And be able to control those so that you can avoid cracking of the irradiated material when you're welding it. And they're making really good progress on this.

But again, this is just to show you a little bit about what we're trying to do in this area. And then in integrated research. This has to do with Zion. We've been working with them since about 2011. And this is, again, in collaboration with the USNRC, EPRI and others. Trying to harvest materials that have, from the reactor as they decommission it.

We're interested in thru-wall reactor pressure vessel sections. We're interested in cables and concrete bore samples. With, I don't know if Sheila Ray is still in the room. But the first thing that we were able to harvest were six control rod drive mechanism cable bundles, which include the power cable, position indicator and the thermocouple.

And they were harvested in the fall of 2012. And I believe that NRC has a contract with NIST. And they've begun looking at those as well. We're going to be sending our cables to Sandia for their cable work.

We're also, back in August we had another tour and visit to the containment area, in August of 2013. We're interested in cables that I think Sheila briefly mentioned, that are both in thermal and radiation environments. High thermal environments near the steam tunnel. And then areas outside of that, the cable spreading room.

I think she had a picture of that, that more benign or controlled environment for comparison. And then eventually we'd like to be able to get cables from submerged environments such as tunnels between buildings. That won't happen for a considerable period of time. Because again, we're depending upon their decommissioning schedule.

That's their primary goal is to do that. And I think they told us they're happy to work with us. But we have to remember, they're not Zion National Laboratory, they're a decommissioning operation. And they have to get it to greenfield by 2020.

In terms of concrete cores, we have had, we visited Zion in December of last year. We've identified a number of sites. This is in the containment area. We'd like to obtain cores from three different elevations in the biological shield.

That can't be done until the reactor pressure vessel is removed. So that will be sometime in the, hopefully in the near future, within a year or so. We'd like to do it just outside the, inside the missile barrier, just below the loop area, outside the missile barrier, and then in the turbine building area, perhaps in the auxiliary building in the cable spreading room.

And again, similar idea in terms of looking at concrete that's been in a radiation environment and a thermal environment, a thermal environment only, and then in more benign. So we're also interested in obtaining reactor pressure vessel segments.

We're interested in obtaining the beltline weld from this section, as well the vertical weld. And then EPRI, CRIEPI and ORNL are interested in obtaining the cold nozzle. Because we'd like to look at the albedo effect, the reflected neutrons. There's very little information about that. And at high fluence there might be some problem with that. So we'd like to look at that.

Just to give you an idea of how big this stuff is, we're talking about fairly large sections. So about a ten foot by five foot section from the --

CHAIRMAN SKILLMAN: Reactor vessel.

MR. ROSSEEL: -- reactor vessel for the nozzle. And these would be five by five feet by five feet. So we're talking about 60,000 pounds of steel hopefully being shipped to, Energy Solutions has a facility, a bonded rad warehouse in Memphis, Tennessee.

And we'd like to do some NDE there, and then cut them up into mechanical specimens, and test them as well. That's on the to do list. I'll skip over that and just go to the summary for the material aging and degradation pathway.

The program has initiated a national material research effort to help provide fundamental and mechanistic knowledge to support extended reactor decisions. And irradiated assisted stress corrosion cracking, RPV issues, concrete, cables, nickel based alloys, NDE, mitigation strategies and integrated research.

The research is collaborative and coordinated with partners around the world. And then going back to that slide about how we try and attack each of the tasks. It has to do with high quality data. It's the measurements to mechanistic understandings, to developing models, to monitoring, as well as mitigation. And with that, pretty close.

CHAIRMAN SKILLMAN: Tom, thank you very much. Let's pause for a minute. Colleagues, any questions or comments for Tom?

MR. ROSSEEL: Stupefied everybody.

CHAIRMAN SKILLMAN: Tom, that was great.

MR. LUBINSKI: Richard, that was great. Thank you.

CHAIRMAN SKILLMAN: Let me now ask John Lubinski to conclude remarks today from the staff.

MR. LUBINSKI: Thank you. I appreciate that, Chairman. Let me first by saying, I appreciate the time that the committee spent with us today. We appreciate the comments and questions we heard today.

Any time we're in front of the Board we like to be questioned about items, make sure that our thinking is sound. And it makes us think and reassess. I appreciate that.

Based on the discussions today, as you know, we said we have a paper in front of the Commission for consideration, as well as our technical review to pass around. I believe from what we heard today, I met with the staff, we didn't hear anything significantly that would change where our views are with the Commission. And we feel comfortable with the paper we have in front of the Commission.

If the Commission does approve our recommendation in moving forward with Option 4, we did hear some information today that is going to help us crystallize the details in moving forward in that area.

Some examples in the regulatory area are, looking at items important to safety, rather than just looking at some of the regulations, and incorporating those. Information on AMP effectiveness, from the standpoint of, what type of criteria are we talking about to look at effectiveness? Is it quantitative, qualitative? How do we assess that?

Also, our communication of some of the options, and the way we're getting those, both internally and externally with the public. I think it was good to get the feedback today, and the questions that are helping us to do that.

With respect to the AMP effectiveness, Jason Remer provided some comments on what the industry is doing in a voluntary manner. And I think again, it's something we're going to have to continue to work with the industry, you know.

We do have questions on the transparency of how those processes work, as well as, again, what type of criteria they're using to determine whether the AMPs are met from an effectiveness standpoint. I appreciate the discussions we had today on the technical issues.

I think the committee, from what you heard today, is very much a coordinated effort, us working with DP doing reviews, DOE working with EPRI, us communicating with EPRI and the industry on what research is done. And as you can see, many of the issues that we think are important, or the ones that need more research, are pretty identical between what NRC sees, DoE, as well as EPRI.

And we appreciate the comments and questions we heard today. Because as we said, we do plan to come back to the committee and talk about where we're going on the technical framework. And it was good to hear the comments and questions, so that we make sure, one, we address them.

And then Number 2 is, having engaging conversation as we come back, and have a good dialogue.

There was a question, I believe, by one of the committee members, as to whether or not the revised GALL would address just Subsequent License Renewal, or would it also be used from the standpoint of those currently going forward.

From the plans at this point we would expect to issue a revised GALL Report that addresses Subsequent License Renewal, with the idea of that being it's beyond 60 years, or maybe changes to the program, different than what we have currently.

Depending on what that comes out with, there will probably be an option for those who are under a current license renewal to either address that new GALL, because it would be more comprehensive and require more details.

But GALL Rev. 2, along with the current ISGs out there could be an option for them as well. But again, that would be in open questions. But that's our goal at this point, to come back with a GALL that supports Subsequent License Renewal beyond 60 years.

Regarding our PRA discussion you heard this morning, and Joe Gitter and Jerry Dozier, I appreciate their comments this morning. I do want to echo two things that Joe said. There was a difference of opinion as we move forward, with respect to PRAs.

And I really appreciate the staff and the agency working with the agency, or looking to the values of the agency in those communications. And I thought that was very good. And I appreciate the non-concurrence process. As an agency I appreciate that we have that process. And I thought that was an effective way to handle the disagreements as we moved forward.

Again, what Joe and Jerry presented this morning are items that the staff heard in doing its exchange of information, as well as in review of the non-concurrence. And we still believe that, again, as I stated earlier, we're on what we believe is the right path as far as handling PRA issues.

We believe PRA is an important tool. We just don't see the linkage to the Subsequent License Renewal at this point. And we don't see a need to have that in place as a requirement to ensure safety during the Subsequent License Renewal period

And as I said, with NEI this afternoon, we've heard their comments before as well. So we appreciate them engaging with us during public meetings. So there was no new information that we had.

We do look forward to coming back to a full committee meeting. I believe we're looking at May time frame to come back for full committee. And we'd appreciate any insights that the committee has, subcommittee has today on what you would like to hear at that full committee meeting.

So, in conclusion, again, I want to thank the committee for its talk today, and sponsoring an all day meeting on Subsequent License Renewal. Thank you.

CHAIRMAN SKILLMAN: John, thank you. On the bridge line. Is anybody there, please?

MS. THOMAS: Yes. Ruth Tomas is on the line. And I had a couple of questions.

CHAIRMAN SKILLMAN: Hello, Ruth. Go ahead.

MS. THOMAS: Hi. Do you anticipate that any new discoveries and developments will affect the plants that you outlined?

MEMBER BLEY: She's supposed to make comments.

CHAIRMAN SKILLMAN: We understand your question. Ad we thank you. Do you have any other comments, please?

MS. THOMAS: Yes. I also wanted to ask about the, I think it's March 24th, where a, yes, it was in the Federal Register. That there was a ruling proposed in relation to the cladding and fuel rods. And the resulting fragmentation of development. And I didn't hear, well maybe that's more specific than what you're getting into.

CHAIRMAN SKILLMAN: Yes, Ruth, we understand your comment. And we thank you.

MS. THOMAS: Well, what's your response.

CHAIRMAN SKILLMAN: We're not going to respond to your questions. We will capture them for the record.

MS. THOMAS: Okay. Thank you.

CHAIRMAN SKILLMAN: Thank you for calling in, Ruth. Are there any other participants on the bridge line, please? Hearing none, let's close the bridge line. Are there any participants in the audience that wish to make a comment, please? And I see that there are none.

Let me thank NEI and EPRI, and DoE and ORNL for your work. Thank you to John and to Bo for the work that you've done to bring your teams together. I believe this has been a very constructive use of our day.

It's an important topic, maybe one of the more important topics that we will touch in my short time on the ACRS. I really appreciate the effort that has gone into this. There's more to come. With that, I thank you. And I'm going to adjourn this meeting. Thank you.

MEMBER STETKAR: Did you want to get comments from the members?

CHAIRMAN SKILLMAN: Excuse me. Yes, I do. Excuse me. Colleagues, comments please.

MEMBER RICCARDELLA: I have no comments.

CHAIRMAN SKILLMAN: Dennis, comments please?

MEMBER BLEY: No. And Bill had to run to an airplane. But he said he'll get you his consultant's report very soon. I've asked all my questions along the way I think. And it's early on. So we'll see how it goes forward.

CHAIRMAN SKILLMAN: Harold?

MEMBER REMPE: Yes. I just wanted to summarize that I don't believe that design bases can or should be subject to routine validation during the tenure of the licenses implied by some of the presentations.

But I do believe that at least the site

related external hazard design bases should be validated at the time of Subsequent License Renewal. And that is assuming that they're not already required to be so validated by the post Fukushima orders, however that finally sorts itself out.

But I just don't believe that during the tenure of the license we should assume that any change at all in the site hazards should be recognized as you go along. I believe in stability from that standpoint.

It's just that after 50 years I think it's time to look and see if there's anything accumulated that needs to be recognized. And I believe the discussions today support that. But I want to summarize it that way.

CHAIRMAN SKILLMAN: Thank you, Harold. John.

MEMBER STETKAR: I don't think I have anything more. I think I already made the points I wanted to. So, thanks.

CHAIRMAN SKILLMAN: Okay. Thank you. Joy.

MEMBER REMPE: Well, I just wanted to add my thanks to all the staff as well as DoE and EPRI, and NEI. Again, I think sometimes maybe we take for granted this non-concurrence process. But I really do appreciate the opportunity that people have to document their concerns. And I think it actually shows an interest by the staff, which I think is nice to see. So I just felt like commenting on that.

There was one thing that I know I heard today about, well, we might have incomplete knowledge, but we can always replace a component. And I'm not so sure that's true with concrete.

And so I am very interested in seeing the results come out from that effort, and learning more about it. And as we just go forward and discuss the technical issues on the effects of Subsequent License Renewal. And that's it.

CHAIRMAN SKILLMAN: Thank you, Joy. Charlie.

MR. GUNN: I asked mine going along. And I got a lot out of the presentation. So, thank you.

CHAIRMAN SKILLMAN: I thank you very much. This meeting is adjourned.

(Whereupon, the meeting in the above-entitled matter was adjourned at 5:33 p.m.)

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

Subsequent License Renewal

Division of License Renewal
U.S. NRC Office of Nuclear Reactor Regulation
Division of Engineering
U.S. NRC Office of Nuclear Regulatory Research
April 8, 2014

Agenda

- Regulatory Framework
  - Overview of License Renewal
  - License Renewal Status
  - Lessons Learned
  - Subsequent License Renewal (SLR)
  - Suggested Rule Considerations
  - Non-Concurrence
- Technical Framework
  - Key Technical Issues

Regulatory Framework

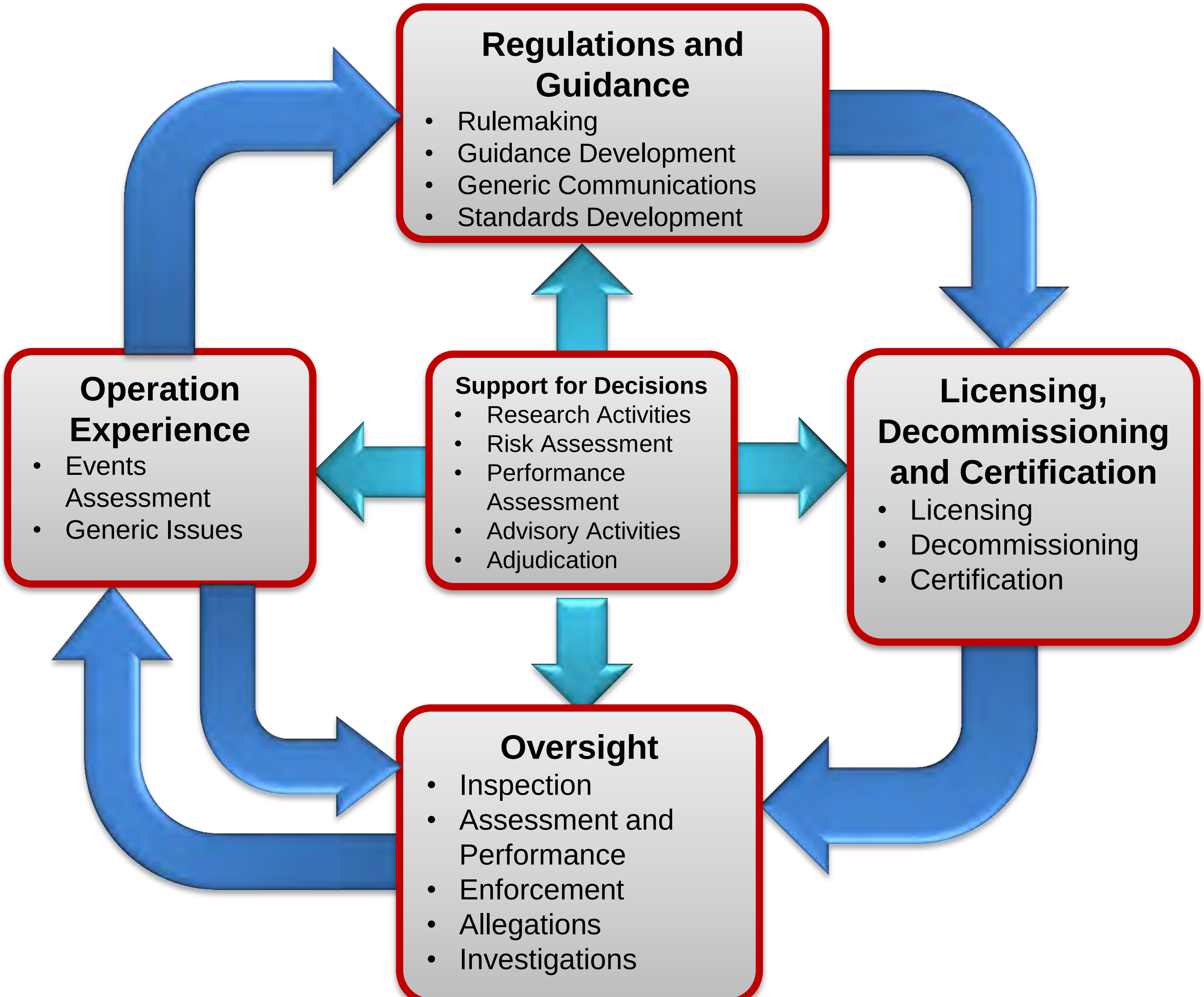
Division of License Renewal
U.S. NRC Office of Nuclear Reactor Regulation
April 8, 2014

First 40 Years

- Safety Review
  – Ensures adequate protection of public health and safety and the environment through the regulatory process (e.g., rulemaking, licensing reviews, inspections, enforcement) and incident response

- Environmental Review
  – Comprehensive assessment to evaluate the potential environmental impacts and benefits of the plant

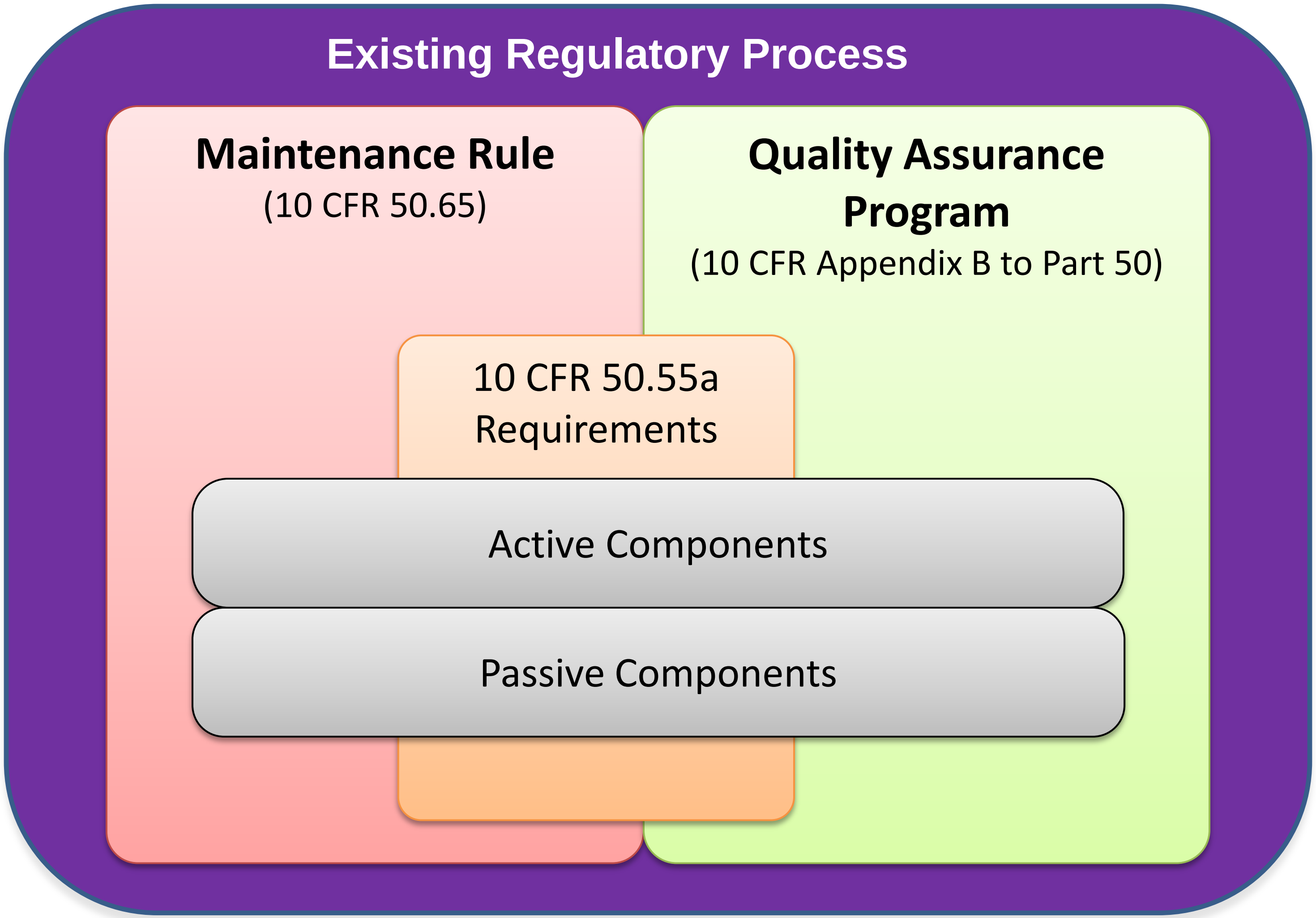
Safety First 40 Years



Safety First 40 Years

- Relies on the current regulatory process
- Identification and resolution of generic safety issues
- Current licensing basis (CLB) is constantly updated by changes approved by the staff, mandated by the NRC, and changes volunteered by the licensee

Safety First 40 Years Aging Management



First License Renewal

- Safety Review (10 CFR Part 54)
  - Provides reasonable assurance that actions have been or will be taken to manage aging of long lived passive components important to safety throughout the period of extended operation (PEO)

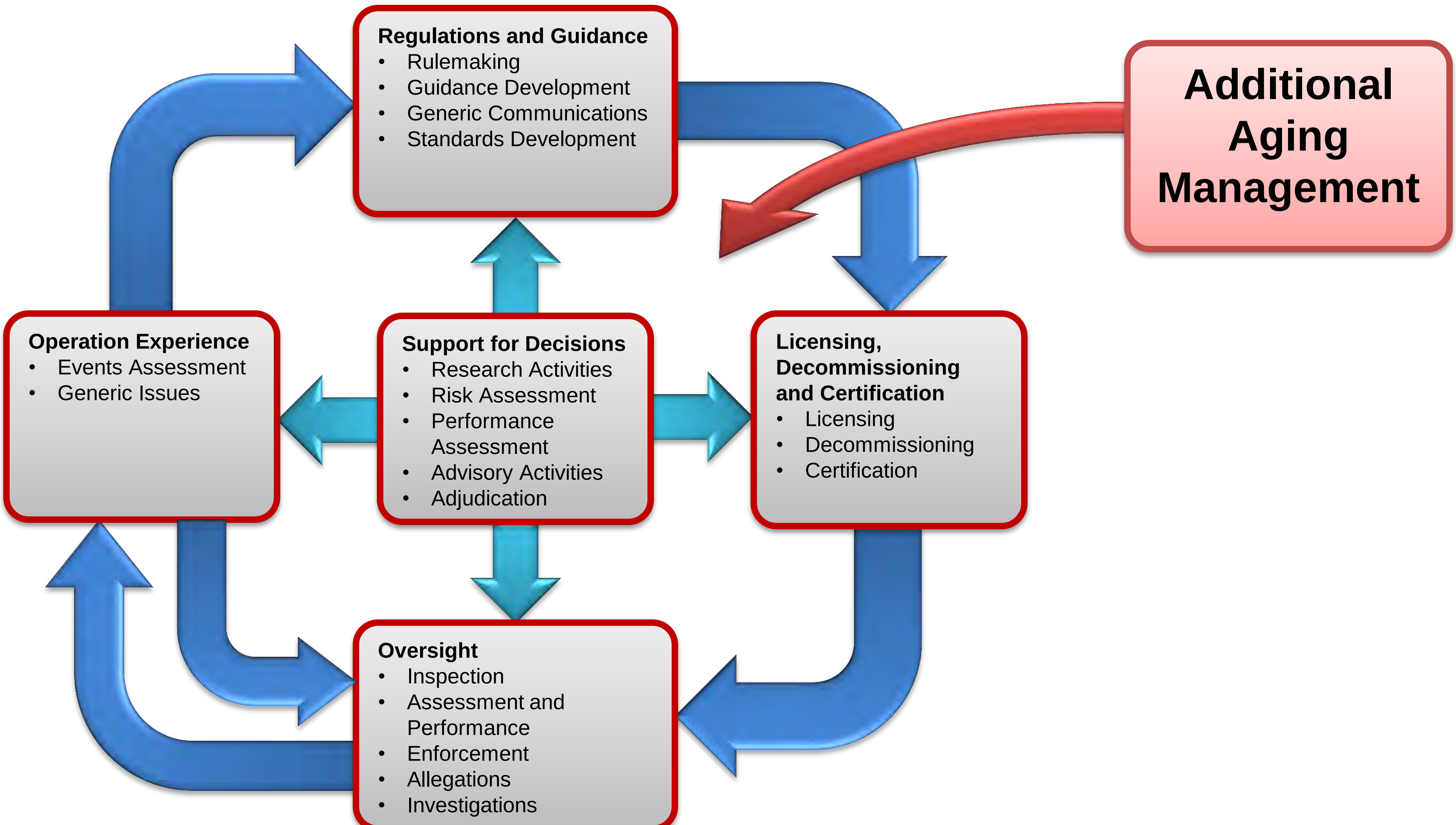
- Environmental Review (10 CFR Part 51)
  - Review of whether the environmental impacts preclude license renewal

Principles of License Renewal Safety Reviews

- **With the possible exception of the detrimental effects of aging on the functionality of certain plant systems, structures, and components, <u>the regulatory process is adequate</u> to ensure that the licensing bases of all currently operating plants provides and maintains an acceptable level of safety so that operation will not be inimical to public health and safety or common defense and security**

- **Each plant's licensing basis must be maintained during the renewal term, in part through management of age-related degradation**
  - 56 FR 64946; December 13, 1991

Safety First License Renewal



Safety First License Renewal

Existing Regulatory Process

Maintenance Rule
(10 CFR 50.65)

Quality Assurance Program
(10 CFR Appendix B to Part 50)

10 CFR 50.55a Requirements

License Renewal

Aging Management
(10 CFR 54)

Ensures that the effects of aging will be effectively managed throughout the period of extended operation

Active Components

Passive Components

License Renewal Status

- 73 units have been relicensed
- 38 units will be in the PEO and eligible for SLR by the end of 2014
- 18 units currently under review
- 9 upcoming applications between 2014 and 2018
- First SLR application expected in 2018
- Older plants will reach the end of 60 years in 2029

Lessons Learned

- Existing principles for license renewal are effective
- Continuous learning in license renewal
- External stakeholder interaction
- Reviews of applications
- Two revisions to *Generic Aging Lessons Learned (GALL) Report*
- Implementation of aging management programs and activities

SLR Key Messages

- Two principles of license renewal will continue to be applied to SLR

- Staff assessment of the current regulatory framework resulted in a dual path for SLR
  - Regulatory framework is addressed in SECY paper
  - Technical framework will continue parallel to regulatory framework

- SLR focuses on lessons learned from first license renewal

SLR Regulatory Framework Considerations

- Over 60 potential issues identified
- Disposition Criteria:
  - Outside the scope of license renewal
  - Best addressed through guidance
  - Best addressed through rulemaking

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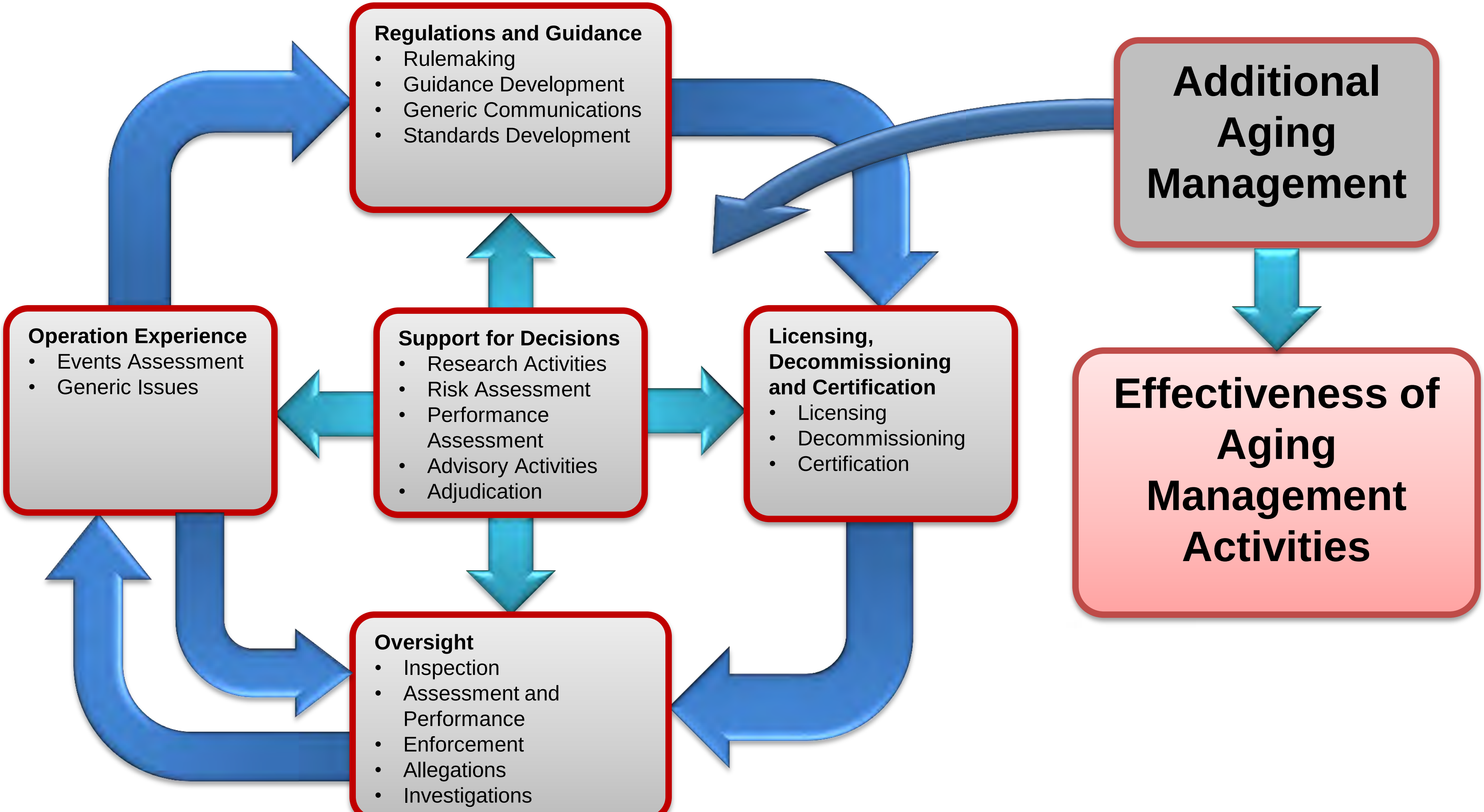
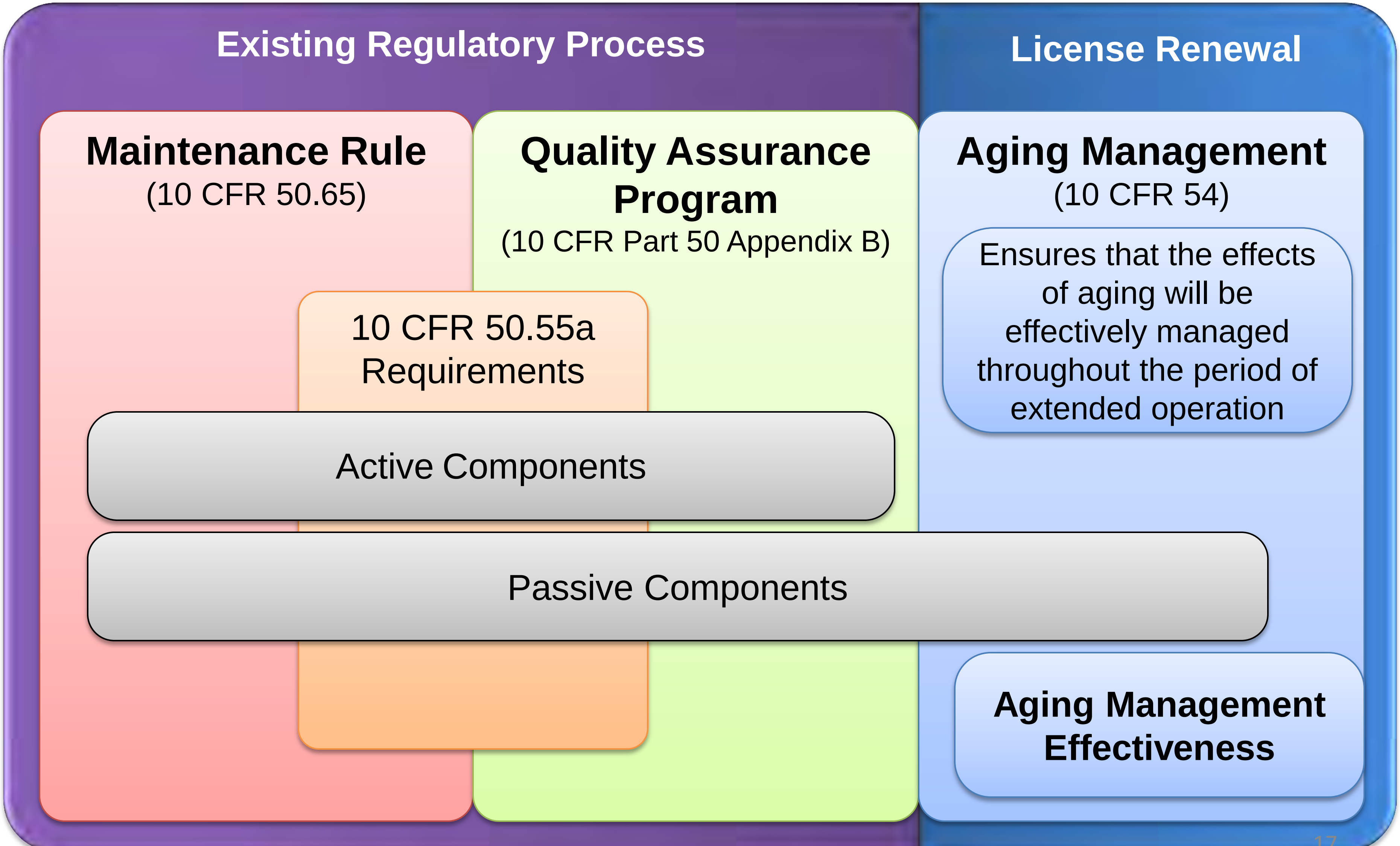
Safety Beyond 60 Years



Safety Beyond 60 Years



SECY-14-0016 Overview

- Requests to explore suggested rule changes to the current regulatory framework to support SLR
- Contributes to the NRC's Principles of Good Regulation
  - Independence, **Openness, Efficiency, Clarity** and Reliability
- Achieves alignment between regulations, guidance and implementation
  - Allows for a stronger basis in our decision making

SECY-14-0016 Overview

- **Option 1**: No changes to the existing Part 54 regulations
- **Option 2**: Minor editorial changes Part 54
- **Option 3**: Updates Part 54 to expand the scope of the rule
- **Option 4**: Pursues rulemaking for SLR specific changes

Suggested Rule Considerations

Option 2: Change scope requirements of 10 CFR 54.4(a)(3) to acknowledge other rule changes

- 10 CFR 50.61a references alternative fracture toughness requirements to ensure protection against pressurized thermal shock events
- 10 CFR 50.61 is already within scope
- Including 50.61a provides rule consistency

Suggested Rule Considerations

Option 2: 10 CFR 54.37(b) "Additional records and recordkeeping requirements"

- Provides requirements for including in the FSAR newly identified SSCs that should be brought into the scope of license renewal and age managed, or should be evaluated as a time-limited aging analysis after a renewed license has been issued
- RIS 2007-16 provides clarification, but confusion still remains
- Staff proposes to revise Part 54 to reflect how recordkeeping requirements apply to newly identified SSCs

Suggested Rule Considerations

Option 3: Add 10 CFR 50.54(hh)(2) to license renewal rule scope

- Staff proposes to update the rule to bring into scope SSCs needed to comply with 50.54(hh)(2) (loss of large areas due to fires or explosions)

- Needed to ensure functioning of core and spent fuel cooling and containment for 60-80 years of operation

Suggested Rule Considerations

Option 3: Clarify Timely Renewal Expectations

- 10 CFR 2.109 allows applicants who submit license renewal applications no later than 5 years before the expiration of the license to continue to operate past the license expiration date until the staff has made its safety determination

- Aging management activities necessary for the PEO are required to be implemented only after a license is renewed

- These provisions can create a situation where a unit can enter its PEO without a renewed license and without having its aging management programs in place

- Staff proposes to clarify in Part 54 that licensees must have the aging management programs in place before entering the PEO

Suggested Rule Considerations

Option 4: Effectiveness of Aging Management Activities

- Key element for SLR
- Three Components:
  - Self-assessments
  - Report aging-related degradation
  - Report certain changes to SLR activities

Suggested Rule Considerations

Option 4: AMP Effectiveness Self-Assessments

- NRC requires similar self-assessments in other regulations (e.g., maintenance rule, fire protection, emergency preparedness)

- Information from self assessments will
  - Provide information to NRC and the industry
  - Identify areas of focus and inform decision making

Suggested Rule Considerations

Option 4: Report Aging-Related Degradation

- Ensures that licensee's self-assessment consider all relevant aging concerns

- Helps the staff and industry stay abreast of relevant operating experience

- This knowledge is essential for NRC to effectively regulate and oversee aging management

Suggested Rule Considerations

Option 4: Report certain changes to SLR activities

- Ensures that the staff is aware of significant changes to aging-management activities after a license is renewed

- Staff expects changes to AMPs to be covered by 10 CFR 50.59 processes and is assessing revisions needed to ensure that 10 CFR 50.59 processes will provide effective change management to aging management activities during the license renewal period

Suggested Rule Considerations

Option 4: Timing of SLR Applications

- Part 54 allow applicants for SLR to submit an application at the same time that the applicant is entering its first PEO

- The timeframe does not allow the staff to assess the effectiveness of aging management activities from the first PEO

- Staff proposes to revise the rule to allow more operating time in the first PEO before a SLR application is submitted

Other Rule Considerations

Part 50 rulemaking to address potential changes to the current licensing basis

- Staff proposes to confirm the adequacy of key input parameters to the CLB and environmental surroundings that have changed over time and evaluate the impact of the changes

- Staff will rely on the agency's decision as a result of the post-Fukushima 10 CFR Part 50 rulemaking for SLR

Non-Concurrence

- A non-concurrence was included with the Commission paper

- Requests that the staff provides the Commission with an option that requires applicants for SLR to include an upgraded probabilistic risk assessment (PRA) assessment in the SLR application

Non-Concurrence

- **Staff Position:**
  - PRAs are not needed to ensure safety during the SLR PEO
  - The need for a risk management regulatory framework is not unique to license renewal
  - Part 54 currently allows applicants to risk-inform their aging management activities consistent with the Commission Policy Statement on the use of PRA

Technical Framework

Division of Engineering
U.S. NRC Office of Nuclear Regulatory Research
April 8, 2014

Technical Framework

- Process for developing technical framework
  - Collection of recommendations for changes to GALL and Standard Review Plan (SRP) for SLR
  - Catalogue recommendations in a database for staff expert panels review
  - SLR GALL Production Tool
  - Issue draft GALL-SLR and SRP-SLR in 2015
  - Issue final GALL-SLR and SRP-SLR in 2016

Technical Framework

- Staff identified technical issues from various sources for consideration in the guidance revision:
  - Aging Management Program (AMP) effectiveness audits
  - Periodic Safety Review (PSR) summary reports
  - Relevant domestic and international operating experience
  - Expanded Materials Degradation Assessment (EMDA)

Technical Framework

- **AMP Effectiveness Audits**
  - Understand how AMPs have been implemented in PEO
  - Looked at evolution of AMPs in response to operating experience
  - Provided insights to the regulatory framework

Technical Framework

- **Review of selected PSR summary reports**
  - Limited-scope review of 14 PSR summary reports
  - Identified a few technical issues for consideration in the technical review
- **Relevant domestic and international operating experience**
  - Reviewed to identify potential new aging degradation mechanisms

Research Activities in Support of SLR

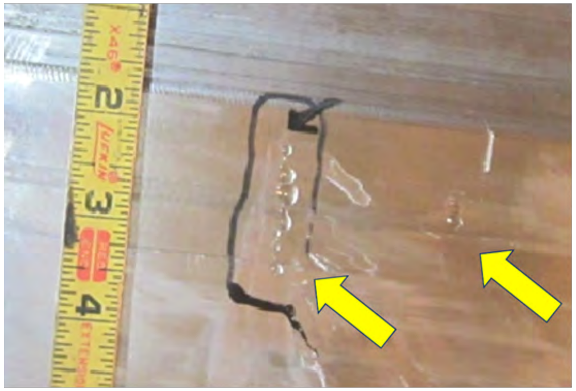
- **Canvas state of knowledge**:
  - Technical workshops
  - International Atomic Energy Agency International Conference on NPP Life Management
  - Nuclear Energy Agency Committee on the Safety of Nuclear Installations Long Term Operations (LTO) activities
- **Periodic interactions through Memorandums of Understanding:**
  - Department of Energy/Light Water rector Sustainability Program and
  - Electric Power Research Institute/LTO Program
- **EMDA:**
  - Builds on Proactive Materials Degradation Assessment (NUREG/CR6923,February 2007)
  - Extends the assessment to operation beyond 60 years
  - Expands the assessment to include reactor pressure vessel, concrete and cable aging in the assessment

Key Technical Issues

- **Piping and Internals Degradation Scenarios**
  - High susceptibility, high knowledge scenarios
    - Stress corrosion cracking (SCC) of Alloy 600/82/182 components
    - Irradiation creep of stainless steel core internals
    - Pitting and microbially induced corrosion of carbon steel in secondary and tertiary systems
    - Fatigue of small-bore welds
  - High susceptibility, low knowledge scenarios
    - All related to moderate-to-high fluence effects on degradation of stainless steel core internals
    - Loss of fracture resistance, SCC, and void swelling of bolts and other components

Key Technical Issues

- **Piping and Internals Degradation Scenarios**



Key Technical Issues

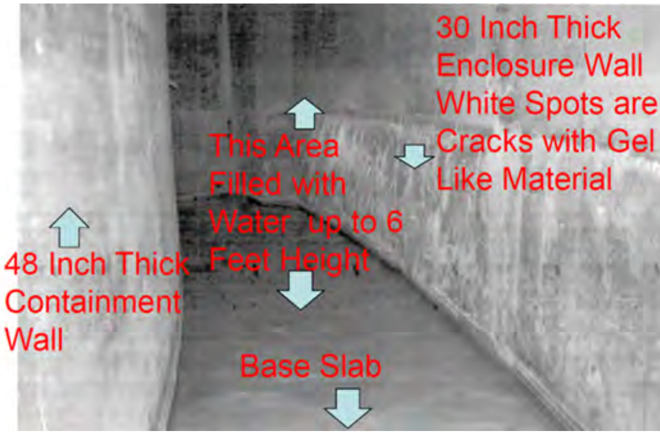
- **Reactor Pressure Vessel Degradation Scenarios**
  - High susceptibility, high knowledge scenarios
    - Embrittlement of carbon and low-alloy steel vessel shells, weld, and nozzles
    - SCC of Alloy 600/82/182 nozzles and welds
  - High susceptibility, low knowledge scenarios
    - No scenarios identified as high susceptibility and low knowledge
  - Intermediate susceptibility, low knowledge scenarios
    - Environmentally-assisted fatigue of stainless steel cladding and nickel alloy components

Key Technical Issues

- **Cable Degradation Scenarios**
  - High susceptibility, high knowledge scenarios
    - Thermal aging of neoprene and ethylene propylene rubber cables
    - Long-term irradiation damage
  - High susceptibility, low knowledge scenarios
    - Long-term wetting of low and medium voltage cables

Key Technical Issues

- **Civil Structures Degradation Scenarios**
  - High susceptibility, high knowledge scenarios
    - Freeze-thaw damage of containment and cooling tower
    - Alkali-aggregate reactions
    - SCC of steel reinforcement bar and tendons
  - High susceptibility, low knowledge scenarios
    - Irradiation damage to concrete
    - Boric acid corrosion of spent fuel pool concrete
    - Corrosion of the back side of the containment liner



Summary

- Plants are required to meet their licensing basis during initial licensing, during first license renewal, and during subsequent license renewal
- Regulatory processes are effective for ensuring licensing basis is met and for identifying and resolving any new safety issues throughout plant operations
- Aging management is reviewed during initial licensing, expanded during first license renewal, and further expanded during subsequent license renewal

Summary

- Suggested SLR regulatory framework creates a more efficient and effective process that results in rule clarity for SLR
- Adequate aging management of technical issues by the industry is critical to enable acceptable understanding of aging management degradation mechanisms and applications for SLR

Summary

- Principles of License Renewal Safety Reviews are adequate and appropriate for Subsequent License Renewal
  - With the possible exception of the detrimental effects of aging on the functionality of certain plant systems, structures, and components, <u>the regulatory process is adequate</u> to ensure that the licensing bases of all currently operating plants provides and maintains an acceptable level of safety so that operation will not be inimical to public health and safety or common defense and security
  - Each plant's licensing basis must be maintained during the renewal term, in part through management of age-related degradation
- The framework proposed by the staff ensures and maintains safety during the period beyond 60 years
- The principles and processes we discussed are policy matters for which the Commission may provide new direction

Option for Upgraded PRA in Subsequent License Renewal

Joseph Giitter

Director, Division of Risk Assessment (DRA)

Jerry Dozier

Sr. Risk and Reliability Analyst, DRA

United States Nuclear Regulatory Commission

Protecting People and the Environment

Why Should PRA be a Consideration for SLR?

Overview

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- Consistency with Commission's PRA Policy Statement
- Consistency with other risk-informed guidance and regulations
- Assure safety goals are maintained
- Promote safety-focused inspection and maintenance

Why Should PRA be a Consideration for SLR?

Policy Rationale

- PRA Policy Statement ("Use of PRA should be increased in ***all*** regulatory matters to the extent supported by "***the state of the art***.")
  - PRA policy statement issued after Part 54 rulemaking.
  - Part 54 SOC (in response to comments from the State of Illinois) acknowledged that PRA methods would be useful on a <u>plant</u> <u>specific</u> basis to assess the importance of SSCs subject to an aging management review.

- PRA "state of the art" has advanced considerably in the last twenty years. (Example: Risk-informed ISI)

Why Should PRA be a Consideration for SLR?

Consistency with New Reactors

- To provide regulatory consistency for combined operating license holders and the existing reactor fleet
  - 10 CFR 50.71(h)(3) requires Combined Operating License (COL) holders to submit an upgraded PRA (one that covers all modes and initiating events) as part of their license renewal application
  - No PRA requirement for current fleet
- An updated PRA requirement would provide consistency with license renewal regulations for New Reactors

Why Should PRA be a Consideration for SLR?

Scoping Consistency

- Scope of Active SSCs in maintenance rule and 10CFR50.69 “Risk-Informed Categorization” are risk-informed

- Current scoping of SCCs for LR is based on deterministic analysis of stylized accidents

- An updated plant specific PRA could potentially identify vulnerabilities beyond the limited design basis

Risk-Informed Safety Classification (50.69)

RISC-1: **•Safety Related** **•Safety Significant** **~25%** **~5000 SSCs**	**RISC-2:** **•Non-Safety-Related** **•Safety Significant** **~1%** **~700 SSCs**
RISC-3 **•Safety Related** **•Low Safety Significance** **~75%** **~15,000 SSCs**	**RISC-4** **•Non-Safety-Related** **•Low Safety Significance** **~99%** **~60,000 SSCs**

(Numbers are approximate values from South Texas Exemption)

As defined in 10 CFR 50.2, Safety-Related SSCs are relied on to:

- Maintain RCS pressure boundary
- Shutdown reactor & maintain safe shutdown condition
- Prevent / mitigate accident which could lead to exposure

Safety Significance is determined using risk metrics & deterministic criteria

Why Should PRA be a Consideration for SLR?

Surveillance and SSC inspection

- An appropriately upgraded PRA may be used to proactively identify the most susceptible aging locations with the highest consequences (similar to Risk Informed In-service Inspections)

- Plant risk profile is changing over time. An upgraded plant specific PRA can reveal, in an integrated fashion, which SSCs are most risk significant and where to focus resources.

Why Should PRA be a Consideration for SLR?

Design Input Parameters

- CLB is based on a stylized scenario that may not represent the greatest risk contributors

- Goal should be to protect the plant against the most risk significant initiators and natural phenomena

- Upgraded PRA that considers all modes/initiators would allow for this in an integrated fashion.

Why Should PRA be a Consideration for SLR?

Design Bases Inspections

- Option 4 discusses how the staff will seek assurance that changes over time to site parameters that may affect the CLB are understood

- The Region’s Component Design Bases Inspection verifies the initial design and subsequent modifications . This procedure prioritizes NRC resources by using risk information and would benefit from having an updated PRA. An updated PRA provides the integrated effect of design changes on risk.

Why Should PRA be a Consideration for SLR?

International and NRC Research experience/insights

- International efforts are underway to evaluate the use of PRA to evaluate the effects of aging on plant risk
- It will become even more important to understand and characterize risk as plants age beyond 60 years—where constant failure rate assumptions may no longer be valid.

Why Should PRA be a Consideration for SLR?

Severe Accident Mitigation Alternatives

- Severe Accident Mitigation Alternatives (SAMA) is currently a significant aspect of License Renewal in the Environmental Report
    - 10 CFR 51.53(c)(3)(ii)(L) does not require a SAMA analysis if it was previously performed (only an evaluation for new and significant information)
    - The SAMA analysis will not be required in SLR
- An updated PRA could provide information regarding the most risk significant modifications to make.

Why wait for SLR Rulemaking?

- Current PRA quality driven by voluntary initiatives
- Uncertain that current staff initiatives (e.g., RMRF) will result in a PRA requirement
- PRA requirement unlikely to pass the backfit rule
- SLR provides a “hard stop” opportunity

Why Should PRA be a Consideration for SLR?

Conclusion

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Fundamentally, the question is, "Do we look to the past to ensure success for the future—with a hope that we've anticipated what the future will hold—or do we try to look into the future to anticipate the probabilities that are likely to exist."

Subsequent License Renewal US Industry Perspective

Briefing for

Advisory Committee on Reactor Safeguards

Plant License Renewal Subcommittee

April 8, 2014

S. Jason Remer
Nuclear Energy Institute

Outline

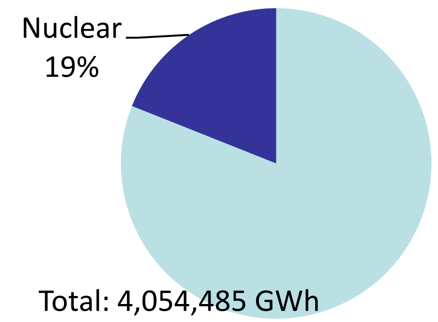
- Factors Supporting Long Term Operation and SLR
- SLR Built Upon Successful LR Programs
- Industry and Government Preparing for SLR and Long Term Operations
- Aging Management – a Living Process
- Detailed Analysis of SECY Paper
- Summary

Factors Supporting Long Term Operation and SLR

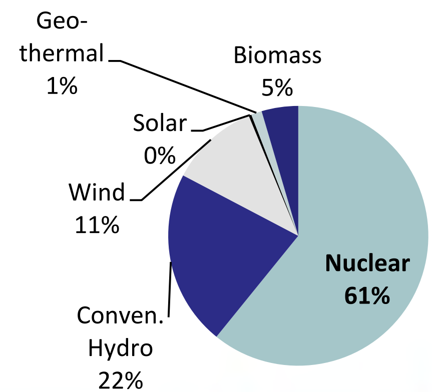
Current Energy Mix

- **Nuclear power is a clean, reliable base load energy source**
  - Provides 19% of U.S. electricity generation mix
  - Provides 61% of U.S. emission-free electricity
  - Avoids about 700 MMTCO2 each year
  - Helps reduces overall NOx and SOx levels
- **U.S. electricity demand projected to increase ~28% by 2040 from 2011 levels**
- **100 GWe nuclear capacity - 100 operating plants**
  - Fleet maintaining close to 90% average capacity factors
  - Most expected to apply for license renewal for 60 years of operation

Electricity Production, 2012



Net Non-Carbon Emitting Sources of Electricity, 2012



Source: Energy Information Administration

Sustained Reliability and Productivity

Highlights

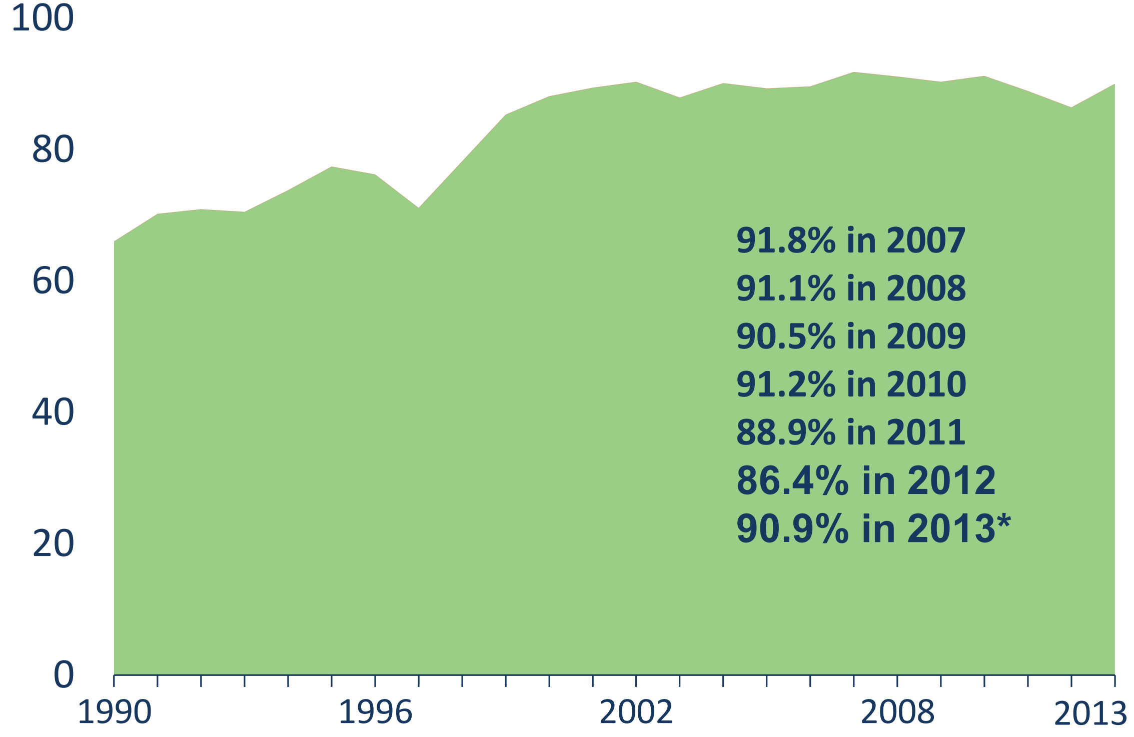
- 2013 average includes San Onofre 2 and 3, which did not operate, and Fort Calhoun, which had a 2% capacity factor for the year. The industry's average capacity factor without those units was 92.1%.
- Number of refueling outages:

  2013 = 51

  2012 = 63

  2011 = 65

U.S. Nuclear Plant Capacity Factor (Percent)



Source: Energy Information Administration

** NEI estimate*

U.S. Nuclear Industrial Safety Accident Rate

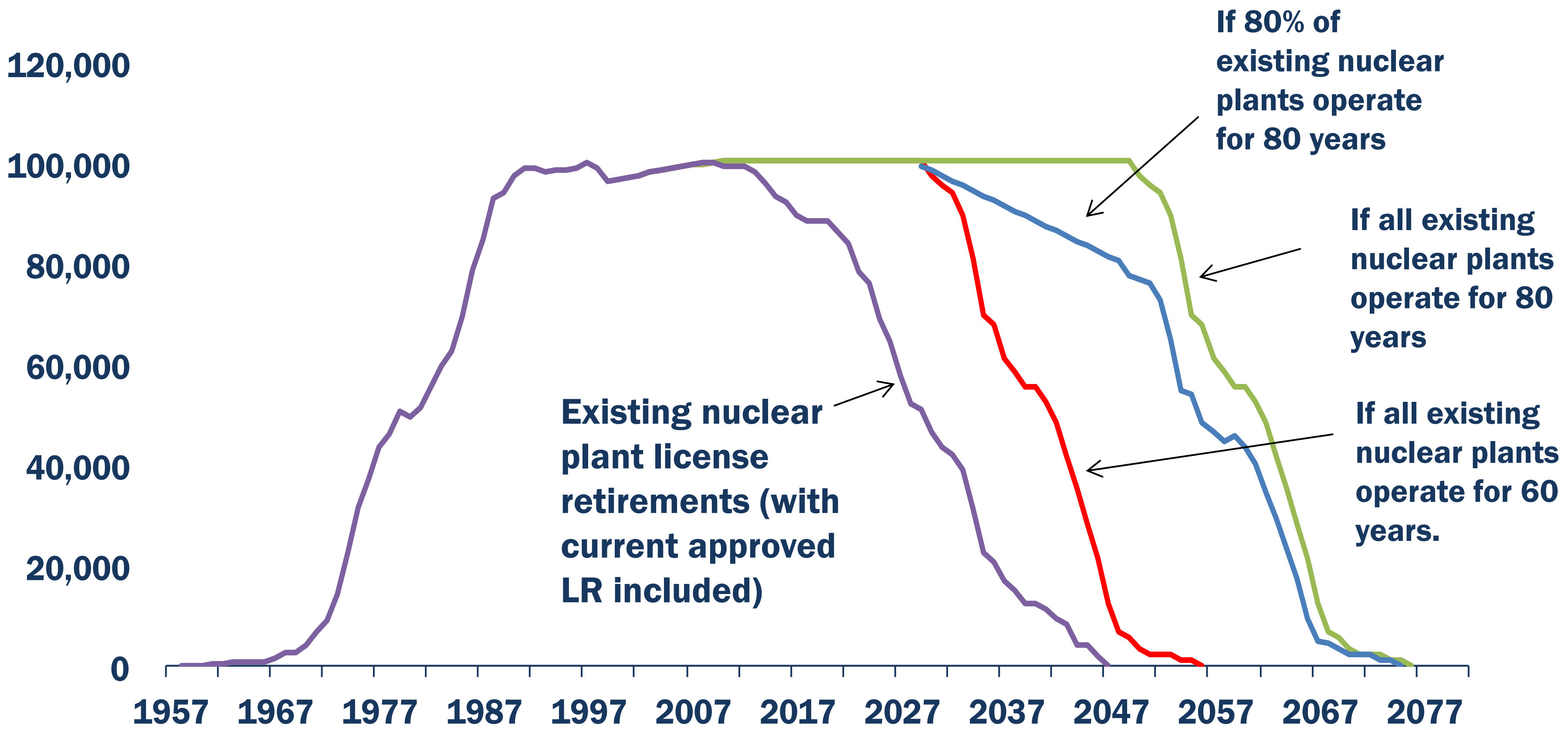
One-Year Industry Values

ISAR = Number of accidents resulting in lost work, restricted work, or fatalities per 200,000 worker hours.

Note: Starting in 2008, data includes supplemental personnel. Source: World Association of Nuclear Operators - Updated: 4/12

Projected U.S. Nuclear Power Capacity

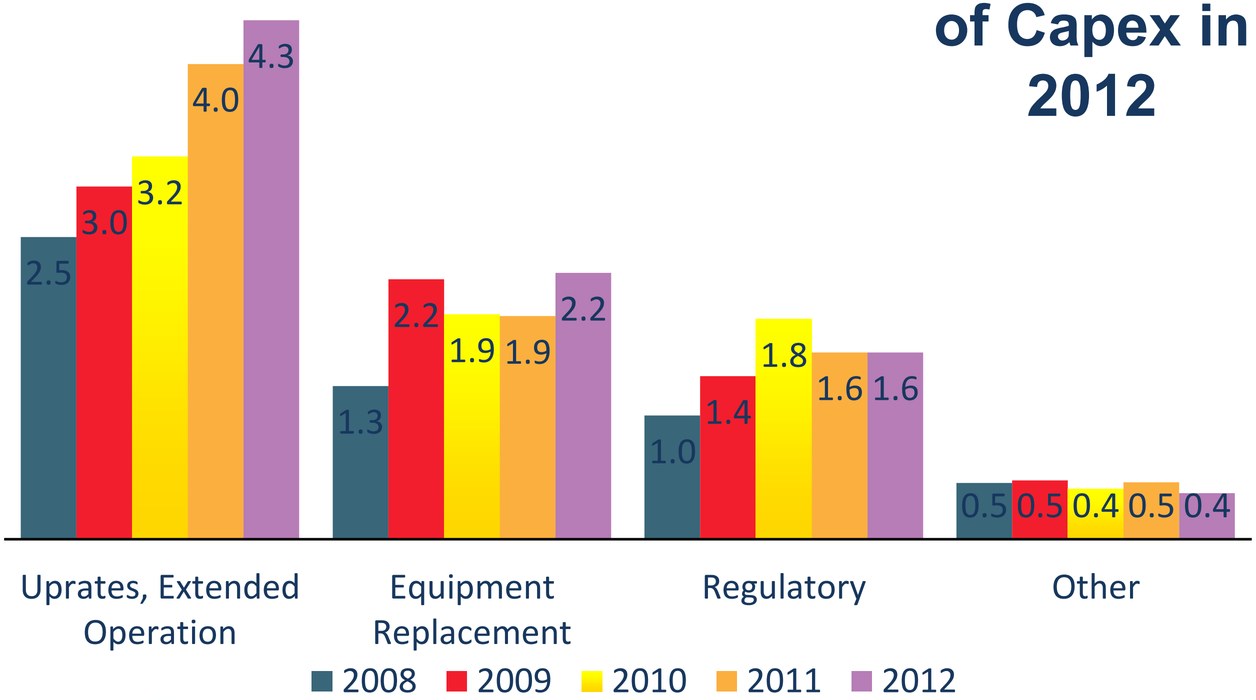
(Megawatts)



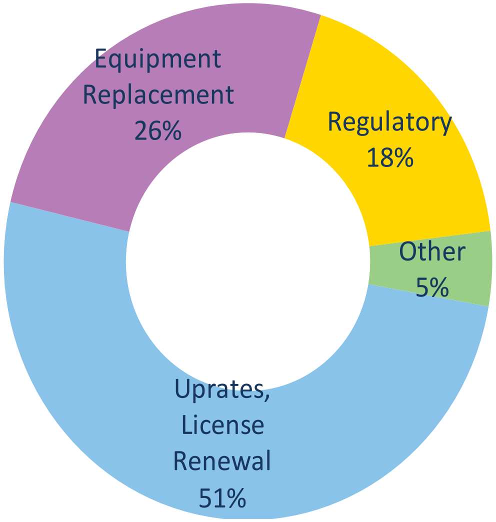
Sources: Energy Information Administration, Nuclear Regulatory Commission Updated: 4/14

2008-2012 Nuclear Capital Spending

(2012 Billions of $)



Distribution of Capex in 2012



Source: Electric Utility Cost Group

Investing in Long Term Operation

$724 Million Grand Gulf Nuclear Plant Uprate Will Soon Create 4,000 Jobs

Nuclear Street News Team Tue, Dec 13 2011 6:28 AM 0

Entergy is preparing for a 13 percent power uprate that will make Grand Gulf the most pow
nuclear plant in the country.

In the process, the $724 million project in Port Gi
expected to create 4,000 jobs. The Shaw Group w
work, and the Natchez Democrat reported that pr
can inquire about opportunities by calling 855-69
www.shawgrp.com/suppliers. Nuclear workers ca
about jobs to hrquestions@shawgrp.com or 866-7

The Democrat this weekend quoted an Entergy sp
saying work is expected to begin in the first quart
Nuclear Regulatory Commission anticipates appro
March, according to the agency's website.

Davis-Besse begins $600M upgrade

Plant replacing generators, plans to stay open through 2037

BY TOM HENRY
BLADE STAFF WRITER

OAK HARBOR, Ohio — Barring complications, it's not that important for northwest Ohio residents to know what steam generators are or how they help nuclear power plants generate electricity.

All they need to know is that during the first weekend of February, FirstEnergy Corp. began following through on its commitment to replace the Davis-Besse nuclear plant's two original steam generators, at a cost of $600 million.

nt Ray Lieb said the investment "supports our commitment to remaining an
Ohio's economy for many decades to come."

StarTribune

Xcel Energy investing $1.8 billion in two nuclear power plants

Article by: David Shaffer
Star Tribune
June 16, 2013 - 8:10 PM

As some U.S. utilities are abandoning old nuclear power plants, Xcel Energy says it's investing $1.8 billion to extend the life of its 40-year-old Minnesota reactors.

At the company's Prairie Island nuclear plant in Red Wing, Minn., 1,550 contract workers this fall will replace two massive steam generators — at $280 million, its single most costly improvement project. The plant was completed in 1974 at a cost of $350 million.

Terry Pickens, Xcel E
policy, stood in front
installed at the Prairi

Richard Sennott , Sta

Nuclear power plant life extension project could cost $1.17bn

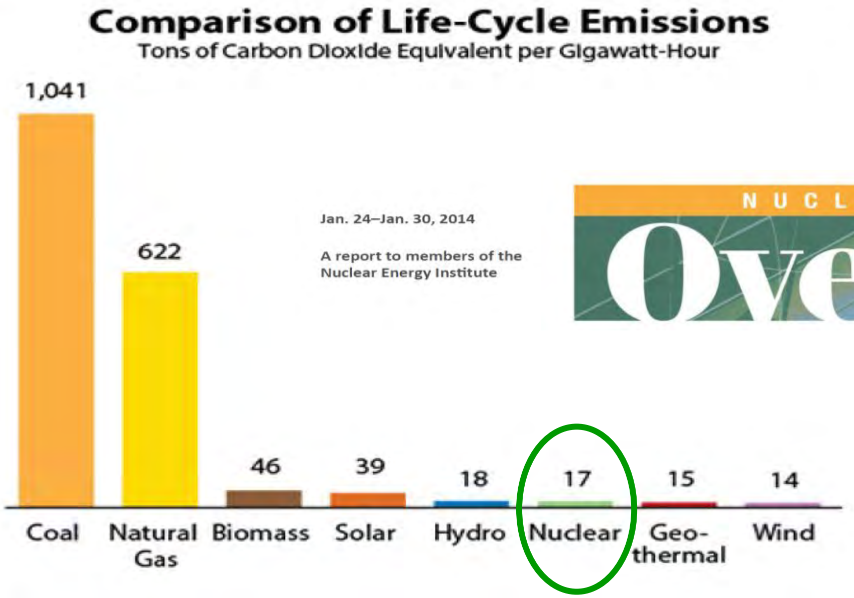
Apr 17, 2012

Indiana Michigan Power (I&M), a subsidiary of American Electric Power (NYSE: AEP), filed a proposal with the Indiana Utility Regulatory Commission (IURC) outlining a $1.17 billion project at the 2,100 MW Donald C. Cook Nuclear Plant in Michigan. The project is expected to sustain the plant over the 20-year extension of its operating license.

Environmental Benefits

Life-Cycle Emissions

Nuclear energy's life-cycle carbon emissions are comparable to those of renewable energy sources.



Jan. 24–Jan. 30, 2014

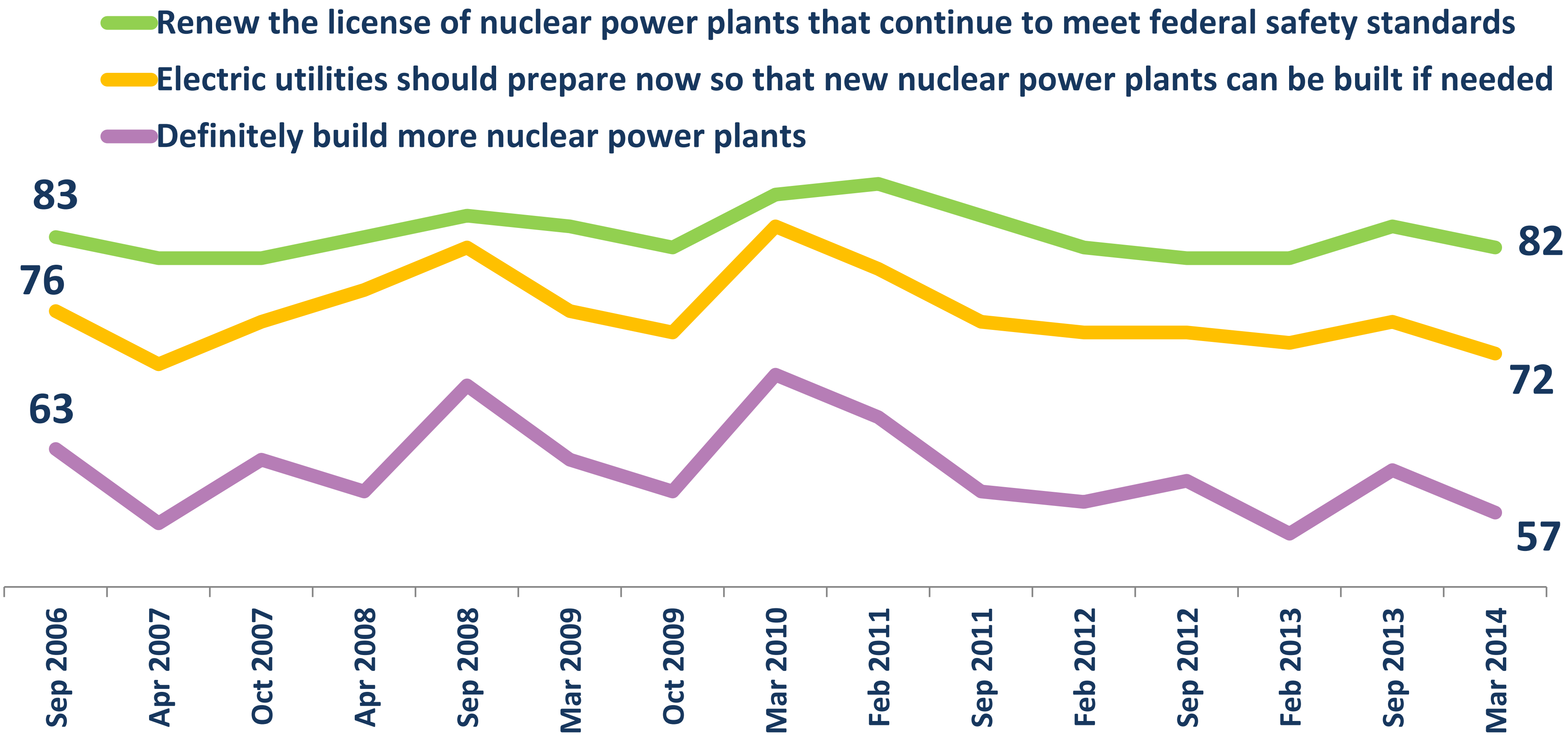
A report to members of the Nuclear Energy Institute

NUCLEAR ENERGY
Overview

Independent studies show that nuclear energy's "life-cycle" emissions of carbon dioxide are about the same as wind and geothermal power and significantly less than other electricity sources. A life-cycle measurement takes into account the facility's construction, the mining and processing of fuel, routine operation, disposal of used fuel and the ultimate dismantling of the facility—in other words, its entire life cycle.

License Renewal and New Plants

% Agree



Source: Bisconti Research, Inc. with GfK Roper and Quest Global Research

NEI
NUCLEAR ENERGY INSTITUTE

nuclear. clean air energy.

Nuclear Energy: A Solid Value Proposition

Safe, Reliable Electricity 24-by-7-by-365 Plus …

- Supports Grid Reliability
- Provides Price Stability
- Provides Clean Air Compliance Value
- Contributes to Fuel and Technology Diversity
- Avoids Carbon Emissions
- Anchors the Local Community: Jobs, Tax Base

SLR Built Upon Successful LR Programs

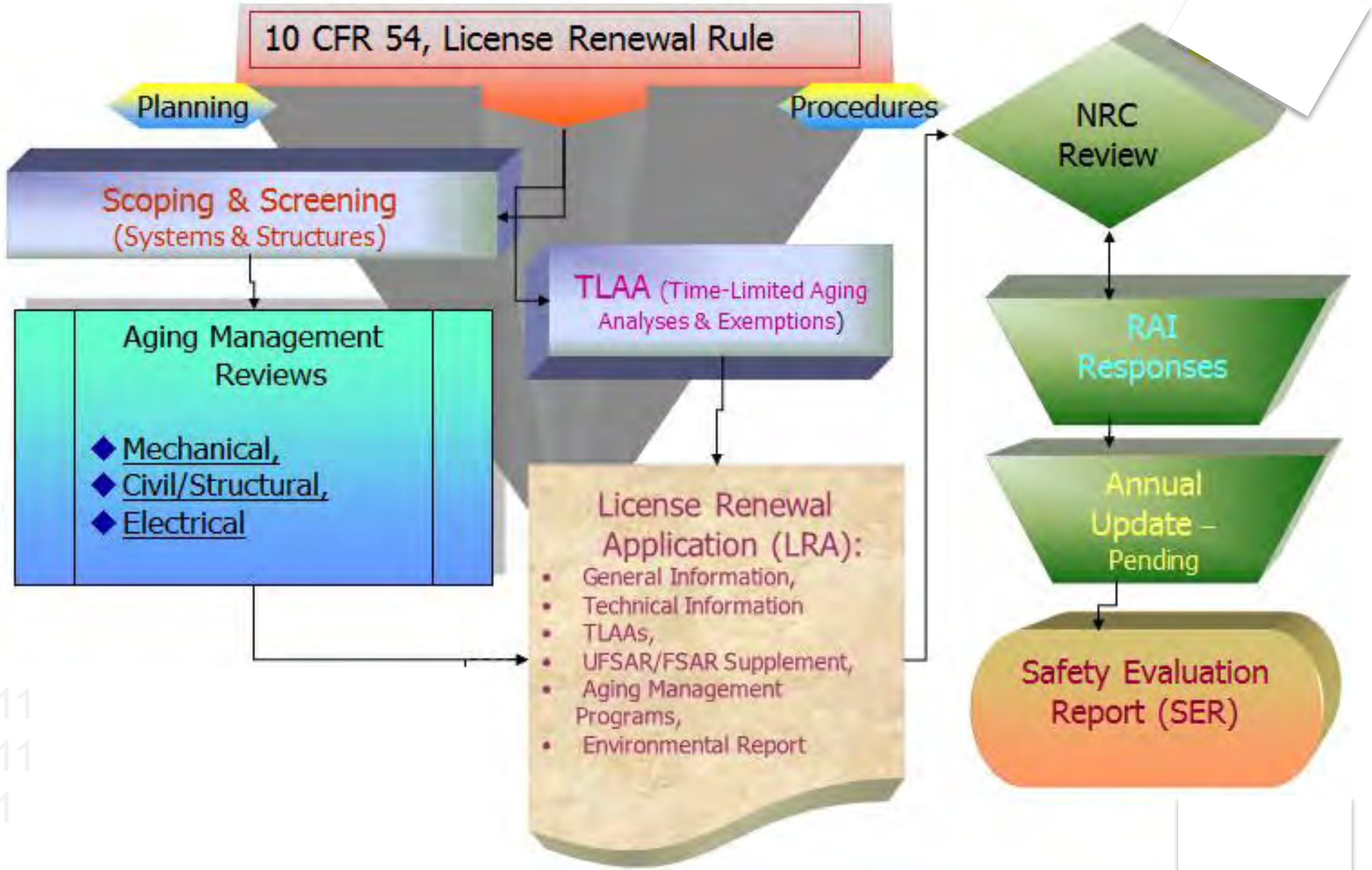
License Renewal

- Atomic Energy Act anticipated and allows for LR and SLR
- NRC process governed by 10 CFR Part 54 and Part 51
  - Original rule issued in 1991, pilot project determined rule was unsuccessful
  - Revised rule issued in 1995, pilot projects successful
- Renewal of original 40 year operating license for additional 20 year terms (i.e., 60, 80, etc. years)
- Aging management for passive, long-lived components and structures; time-limited aging analyses evaluation; environmental impact review
- An option to continue operating existing nuclear power plants
- Two main review areas by NRC: safety, environmental
- Public offered an opportunity to request a hearing

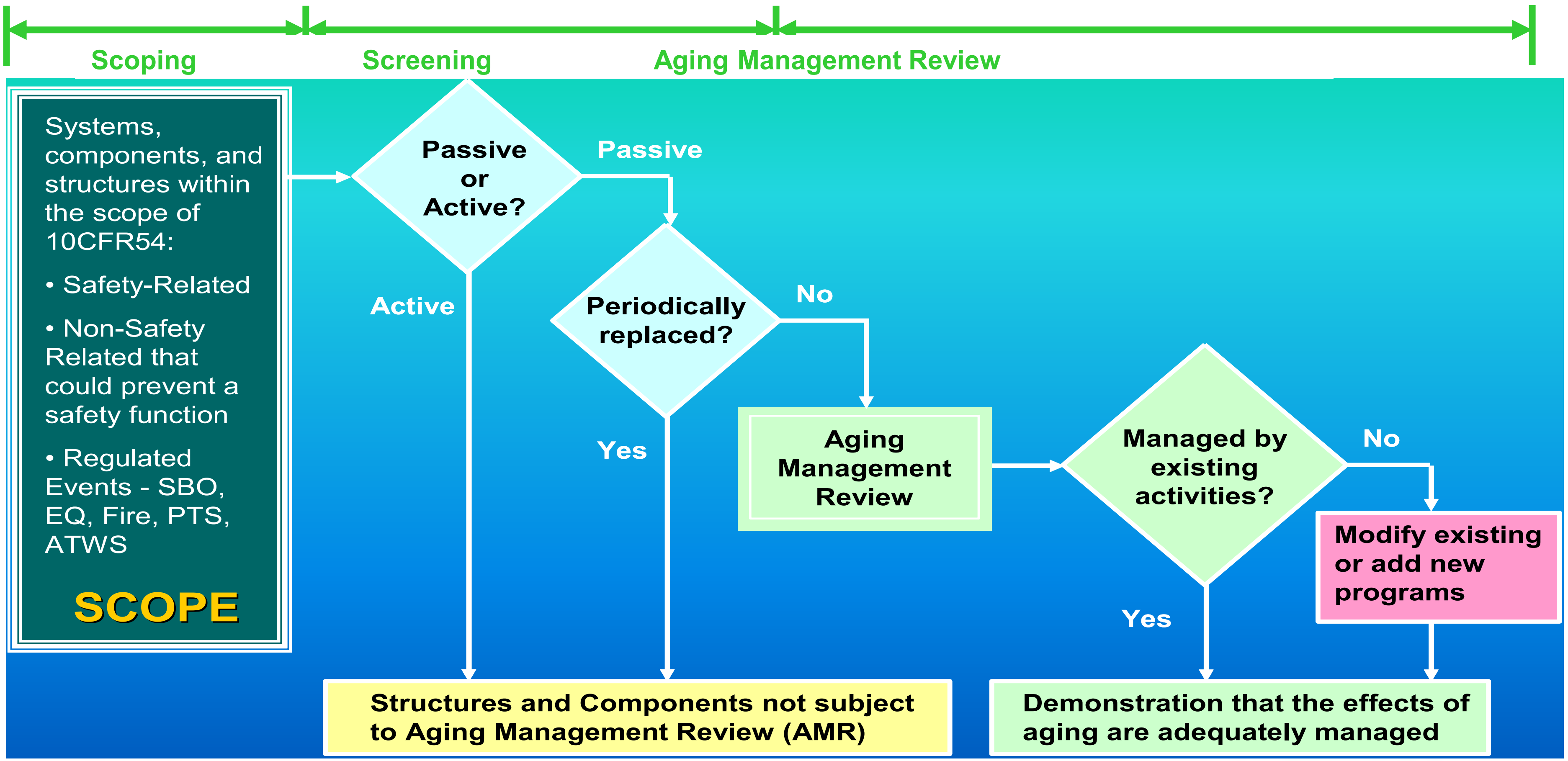
Foundation of License Renewal

- Two key principles:
  - Current regulatory process is adequate to ensure that the licensing basis of all operating plants provides and maintains an acceptable level of safety so that operation will not be detrimental to public health and safety or common defense and security
  - Each plant's licensing basis is required to be maintained during any renewal term in the same manner and to the same extent as during the original licensing term

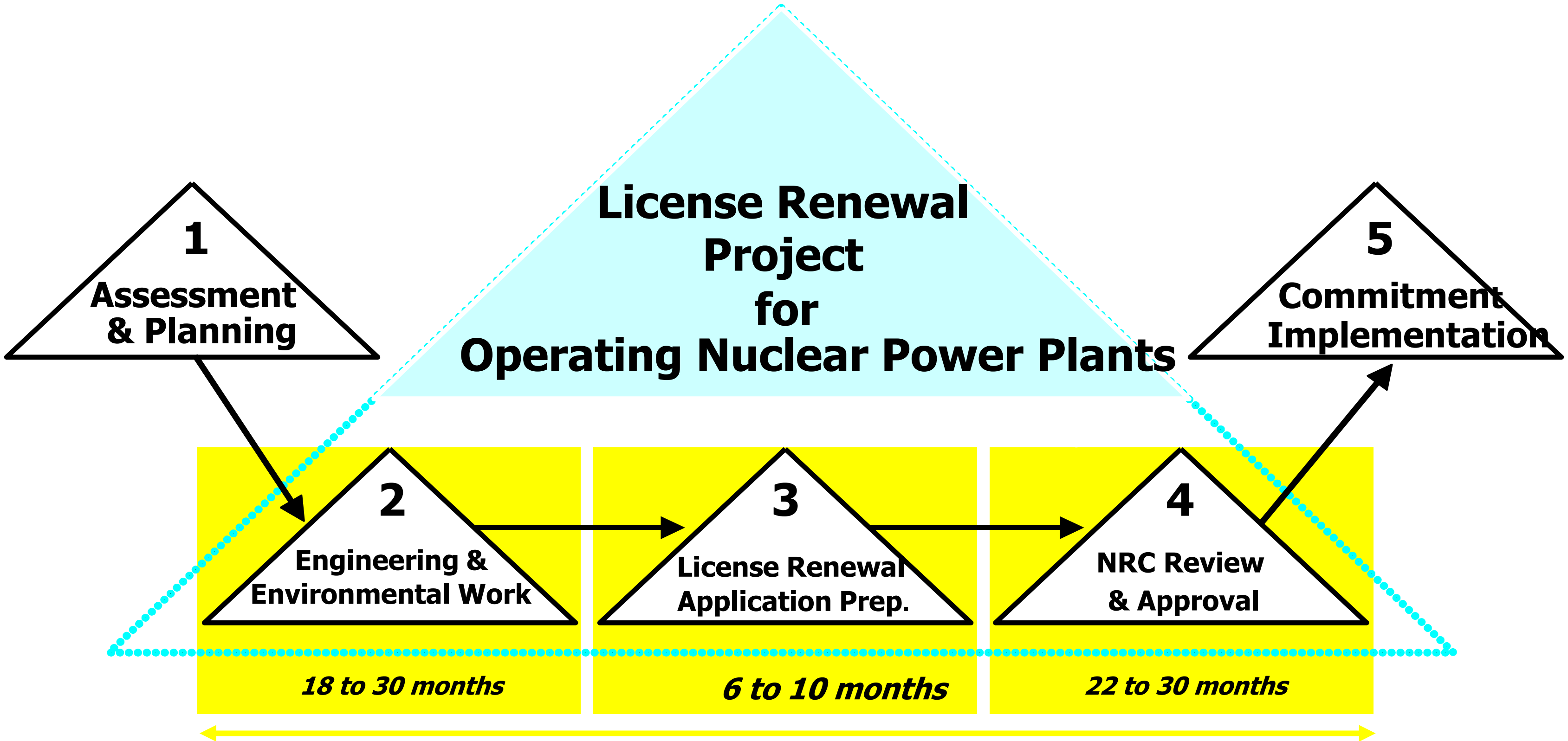
License Renewal Review Process



Elements of an Integration Plant Assessment (IPA) for License Renewal



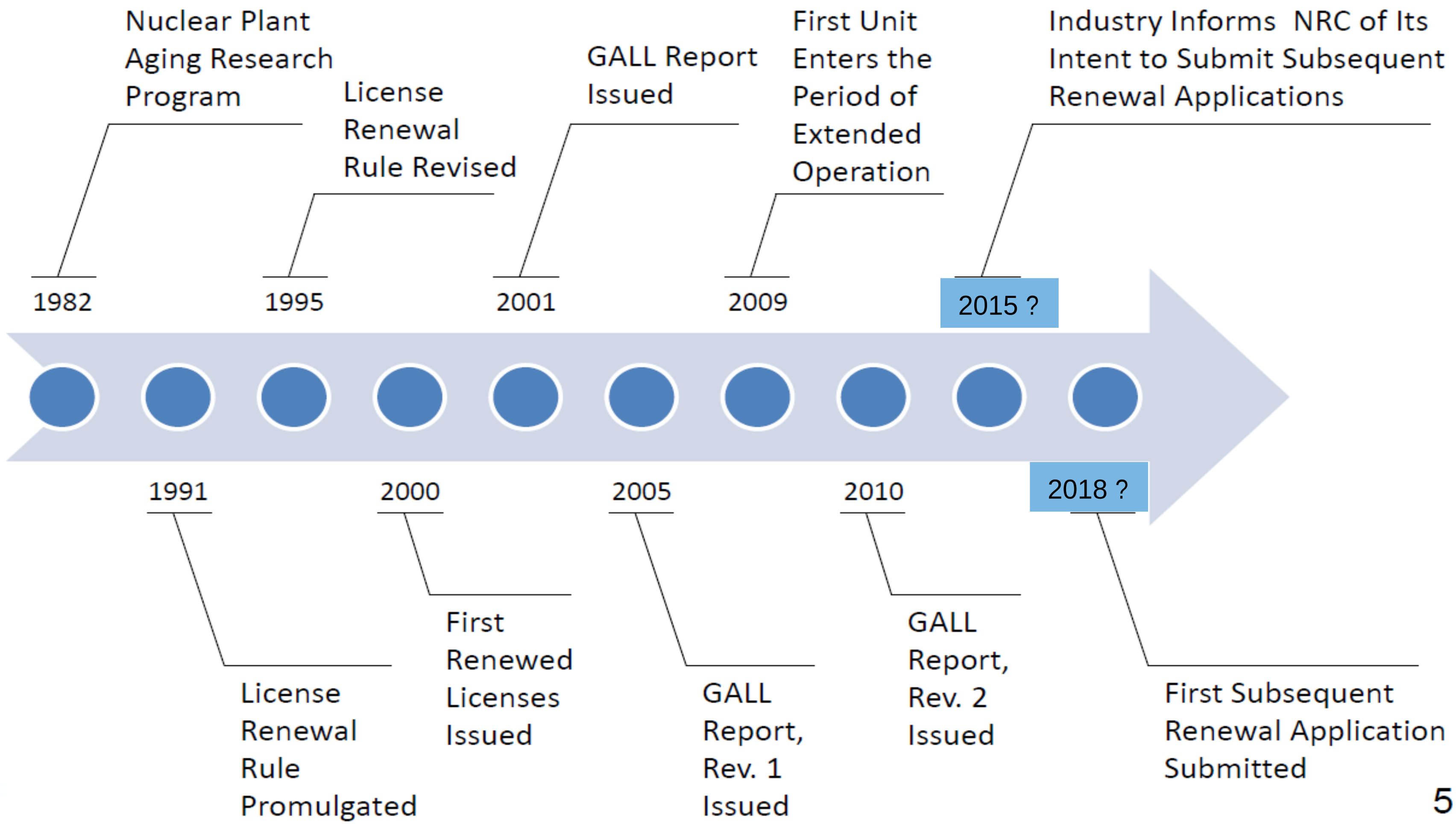
Typical License Renewal Process Phases



Typical Cost and Schedule = $16 to $25 million and 4 to 6 years*

* Not including hearing and implementation Phase (5)

History of License Renewal Rule



U.S. Regulatory & Industry Guidance

Status – on-going revisions of regulatory & industry guidance based on lessons learned and operating experience

U.S. NUCLEAR REGULATORY COMMISSION
Revision 1
September 2005

REGULATORY GUIDE
OFFICE OF NUCLEAR REGULATORY RESEARCH

R.G. 1.188

FOR APPLICATIONS TO RENEW
NUCLEAR POWER PLANT OPERATING LICENSES

A. INTRODUCTION

NEI 95-10
Revision 0

NEI 95-10

Nuclear Energy Institute

Industry Guidelines For Implementing The Requirements of 10 CFR Part 54 - The License Renewal Rule

June 2005

NUREG-1800, Rev. 1

Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants

Manuscript Completed: September 2005
Date Published: September 2005

NUREG-1800

Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

NUREG-1437
Vol. 1, Addendum 1

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Main Report
Section 6.3—Transportation
Table 9.1 Summary of findings on NEPA issues for license renewal of nuclear power plants

Final Report

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

NUREG-1437

NEI 05-01 [Rev A]

NEI 05-01

Nuclear Energy Institute

Severe Accident Mitigation Alternatives (SAMA) Analysis

Guidance Document

November 2005

NUREG-1801, Vol. 2, Rev. 1

Generic Aging Lessons Learned (GALL) Report

Tabulation of Results

Manuscript Completed: September 2005
Date Published: September 2005

NUREG-1801

Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Aging Effects for Structures and Structural Components (Structural Tools), Revision 1

1002950

Final Report, August 2003

EPRI 1002950

EPRI Project Manager
J. Carey

SAND96-0344
Specified Dissemination
Printed September 1996

AGING MANAGEMENT GUIDELIN[E] FOR COMMERCIAL NUCLEAR POWER PL[ANTS] ELECTRICAL CABLE AND TERMINA[TIONS]

Prepared by:
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Under Contract to:
Sandia National Laboratories
Albuquerque, NM 87185
for the
U. S. Department of Energy

Project Manager:
John Clauss

SAND96-0344

Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4

1010639

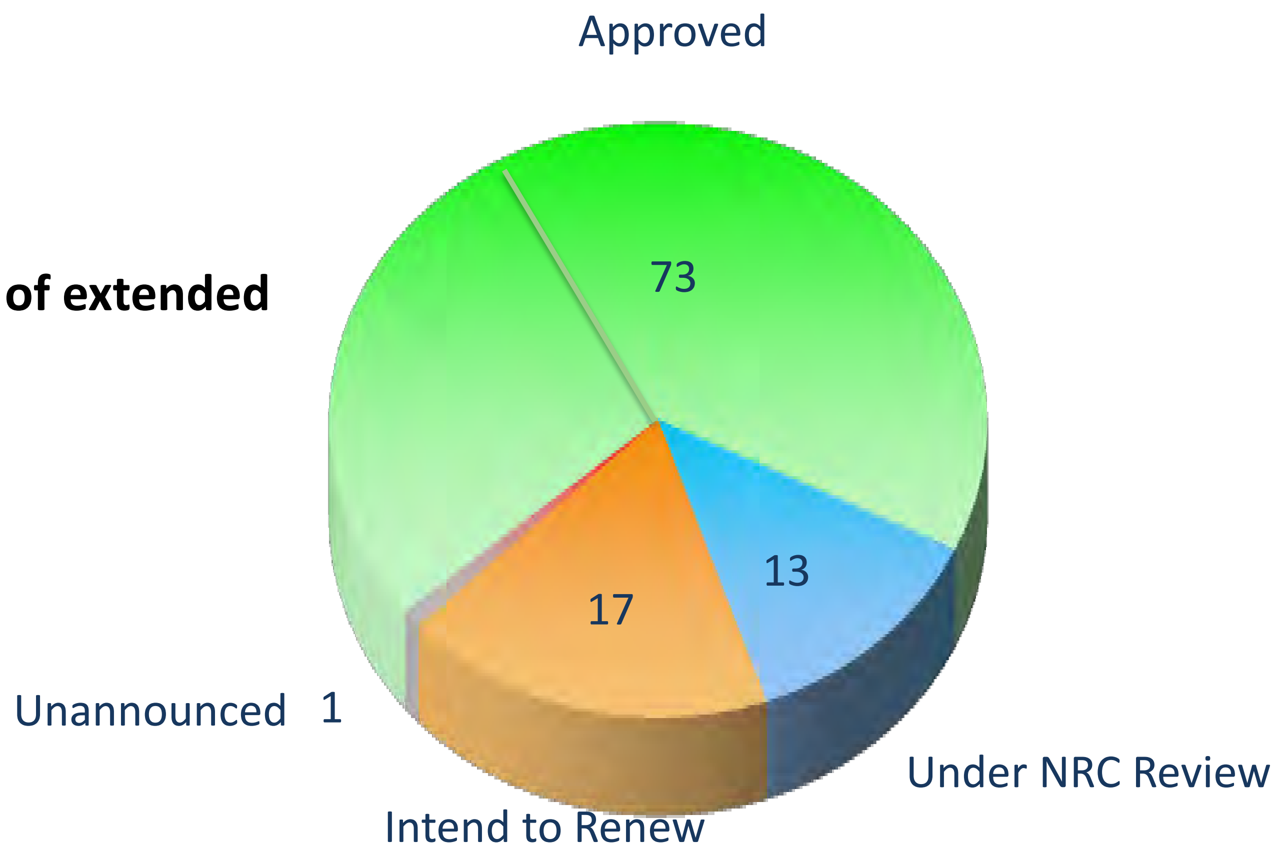
Final Report, January 2006

EPRI 1010639

EPRI Project Manager
J. Carey

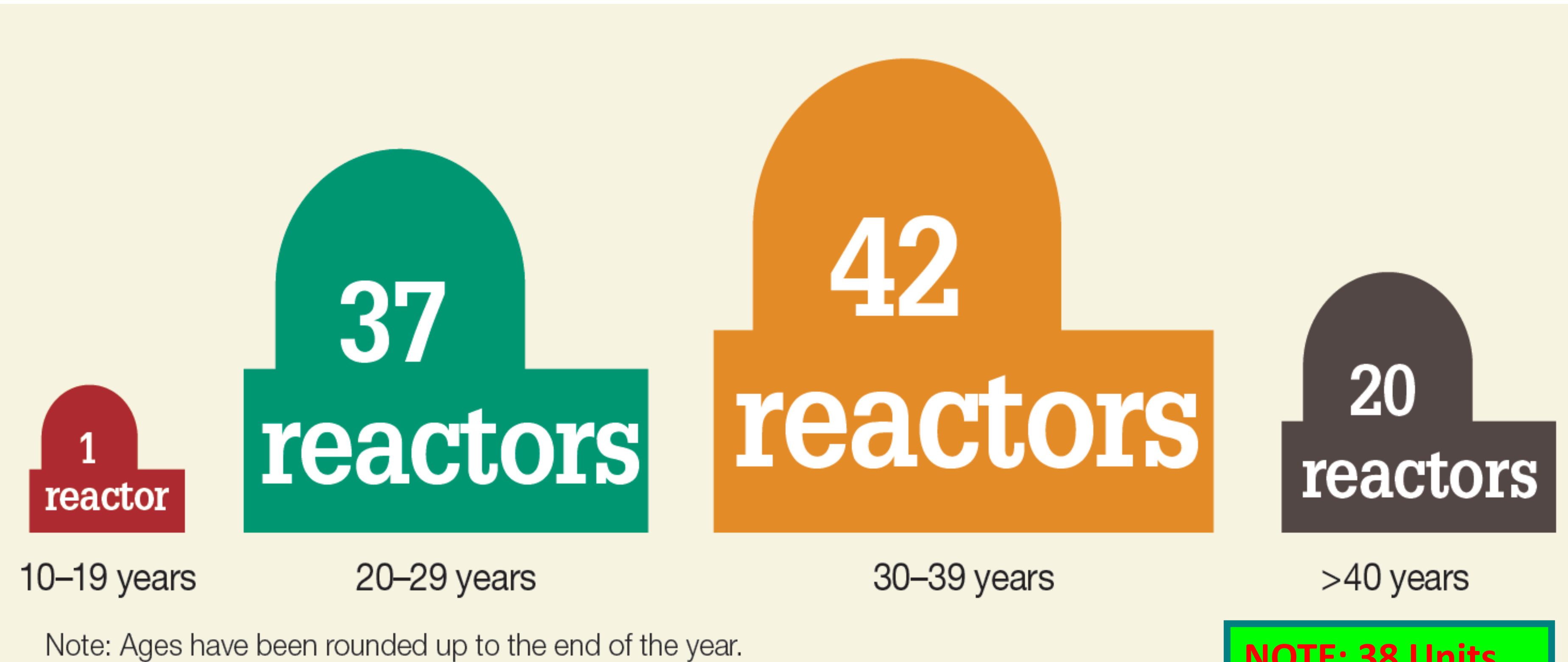
Current Situation

27 in period of extended operation



U.S. NPPs – Years of Operation

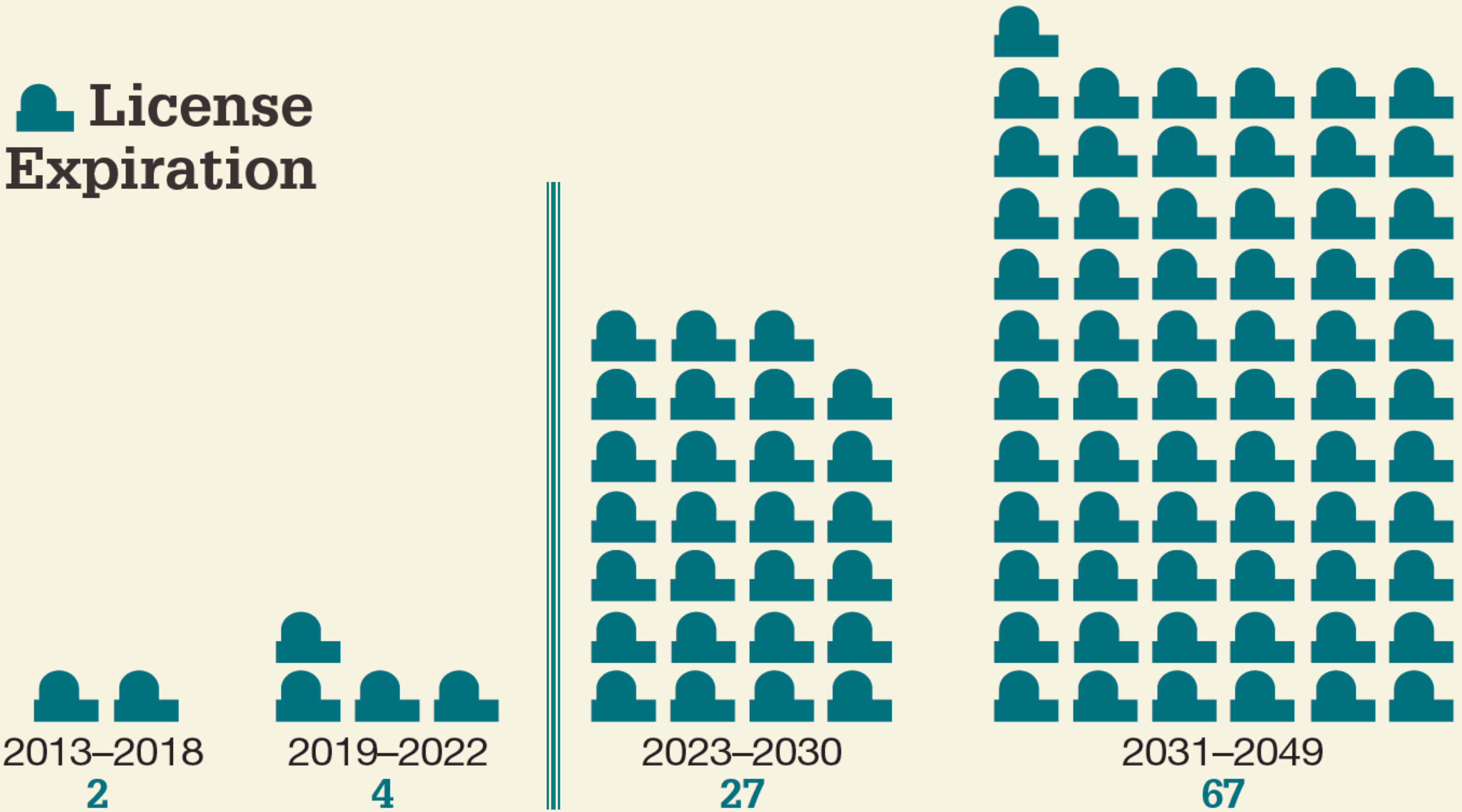
End of NRC FY2013 – NUREG-1350



NOTE: 38 Units >40 years by end of 2014

License Expirations

End of 2013 – NUREG-1350

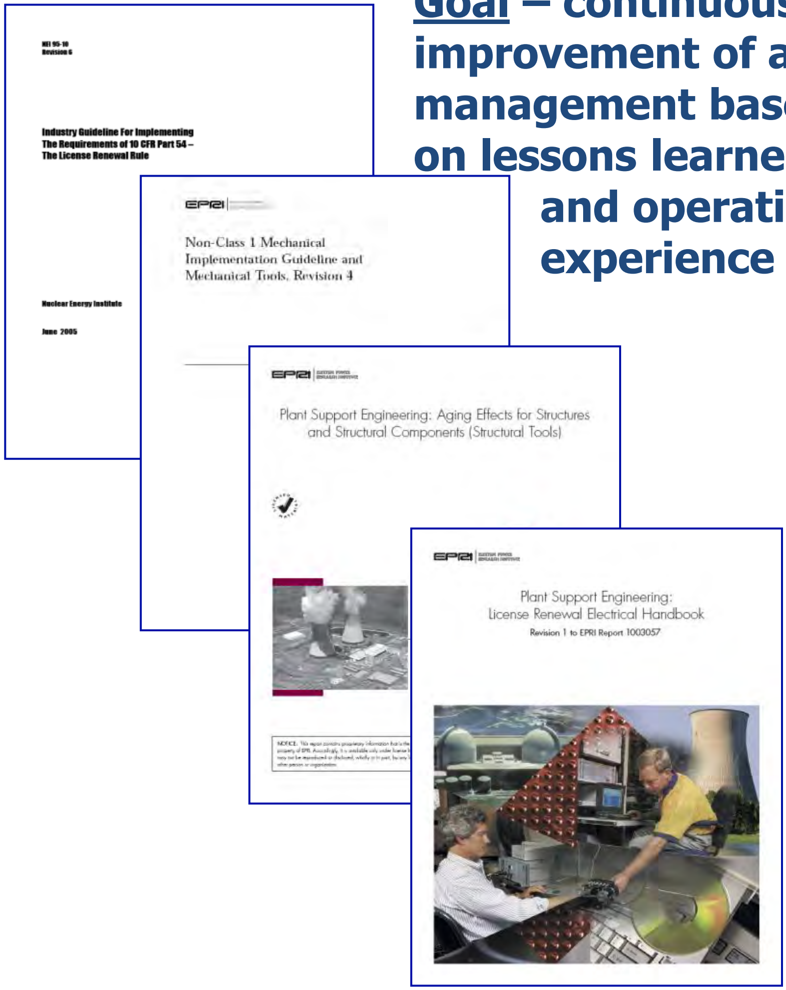


Industry and Government Preparing for SLR and Long Term Operations

U.S. Industry Groups – Supporting SLR

- **NEI LR and SLR Task Force**
  - Regular industry meetings
    - Quarterly industry meetings
    - Quarterly NRC mgmt. meetings
    - SRP & GALL revision recommendations
  - NEI 95-10 industry guidance
  - Industry peer reviews of LRAs
- **NEI License Renewal Working Groups**
  - Mechanical Working Group
    - EPRI Mechanical Tools Doc. Upkeep
  - Electrical Working Group
    - EPRI Electrical Tools Doc. Upkeep
  - Civil/Structural Working Group
    - EPRI Structural Tools Doc. Upkeep
  - Implementation Working Group
    - NRC IP71003, Industry Guidance
  - Subsequent LR Working Group
    - LTO R&D and Licensing Guidance
- **NEI SLR Executive Working Group** [new]
- **ASME Special Working Group – Nuclear Plant Aging Management**

Goal – continuous improvement of aging management based on lessons learned and operating experience



Close Coordination with Research

- ASME Special Working Group
  - Nuclear Plant Aging Management
- EPRI Long Term Operation (LTO) Program
  - EPRI documents identified in GALL in support of first round of LR
  - Subsequent License Renewal
  - Pilot Programs
- Department of Energy's (DOE) Light Water Reactor Sustainability Program (LWRS)
  - Materials Aging and Degradation
  - Advanced Instrumentation, Information, and Control Systems Technologies
  - Risk-Informed Safety Margin Characterization

Meetings in Preparation for SLR and LTO

- NRC and DOE sponsored two international conferences on operation beyond 60 years (2008, 2011)
- Third International Conference on Nuclear Power Plant Life Management for Long Term Operation, organized by IAEA
- NEI Long Term Operation/SLR Forum 2013, Keynote speaker – Chairman Macfarlane
- NEI Long Term Operation/SLR Forum 2014, Keynote speaker – Commissioner Svinicki
- NRC, EPRI involvement with IAEA for development of IGALL

Current SLR Milestone Schedule

2029 License Expires for 1st LR Plants

2024 5 Year Minimum to Submit SLR for Continued Operation Per Timely Renewal

SLR License Approved 9 Years Before Expiration of Original License

2020 1st SLR License Approved by the NRC

2 Years for NRC Review of SLR Application

2018 1st SLR License Application Submitted

2 Years for SLR Application Preparation

2016 Pilot Plant Selected, Begin SLR Submittal Preparations

R&D Supporting SLR ,EPRI/DOE/NRC

Revise GALL and SRP, NEI 95-10

Current Date

NRC Prepares SECY Paper on SLR

AMP Audits for Nine Mile, Ginna, Robinson by NRC

EPRI AMP Review Complete

NRC SLR Public Meeting Series

2009 1st LR Plants Enter the Period of Extended Operation

SLR Roadmap

- Schedule for first SLR license approved
- Actions and deliverables
- References actions for all stakeholders
  - Industry, EPRI, DOE, NRC
  - Coordination of R&D activities
- Announcement of lead plant(s) 2015
- 1st Application(s) expected 2018

Aging Management – a Living Process

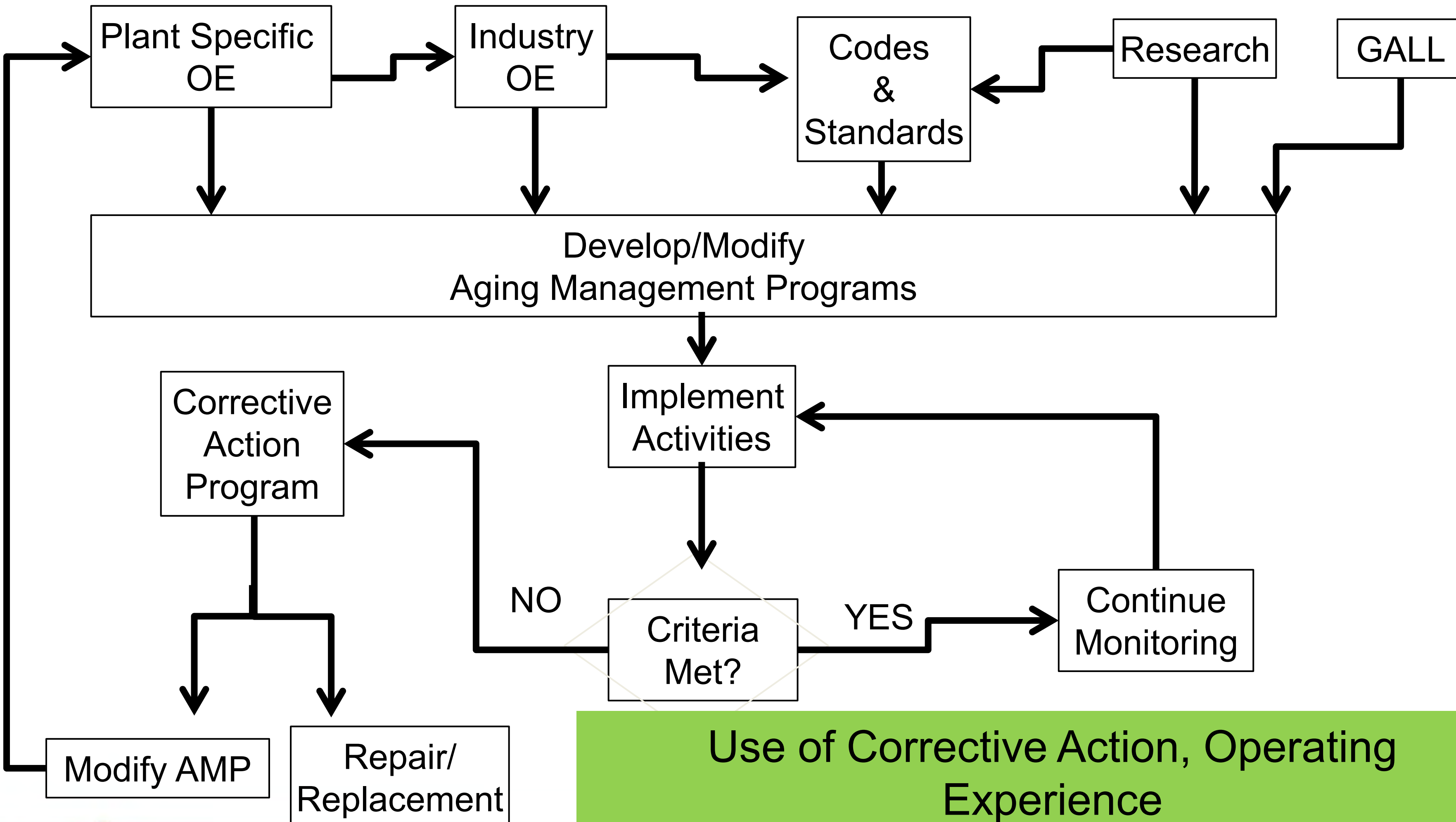
Many AMPs are Based on Mature Plant Programs

XI.M1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD
XI.M2 Water Chemistry
XI.M3 Reactor Head Closure Stud Bolting
XI.M4 BWR Vessel ID Attachment Welds
XI.M5 BWR Feedwater Nozzle
XI.M6 BWR Control Rod Drive Return Line Nozzle
XI.M7 BWR Stress Corrosion Cracking
XI.M9 BWR Vessel Internals
XI.M10 Boric Acid Corrosion
XI.M12 Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)
XI.M16A PWR Vessel Internals
XI.M17 Flow-Accelerated Corrosion
XI.M18 Bolting Integrity
XI.M19 Steam Generators
XI.M20 Open-Cycle Cooling Water System
XI.M21A Closed Treated Water Systems .
XI.M22 Boraflex Monitoring
XI.M23 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
XI.M24 Compressed Air Monitoring
XI.M25 BWR Reactor Water Cleanup System
XI.M26 Fire Protection
XI.M27 Fire Water System
XI.M29 Aboveground Metallic Tanks
XI.M30 Fuel Oil Chemistry
XI.M31 Reactor Vessel Surveillance
XI.M32 One-Time Inspection
XI.M33 Selective Leaching
XI.M35 One-time Inspection of ASME Code Class 1 Small Bore-Piping
XI.M36 External Surfaces Monitoring of Mechanical Components
XI.M37 Flux Thimble Tube Inspection
XI.M38 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
XI.M39 Lubricating Oil Analysis
XI.M40 Monitoring of Neutron-Absorbing Materials Other than Boraflex
XI.M41 Buried and Underground Piping and Tanks

License Renewal Entails a Broad View of Plant Programs(GALL 10 Elements)

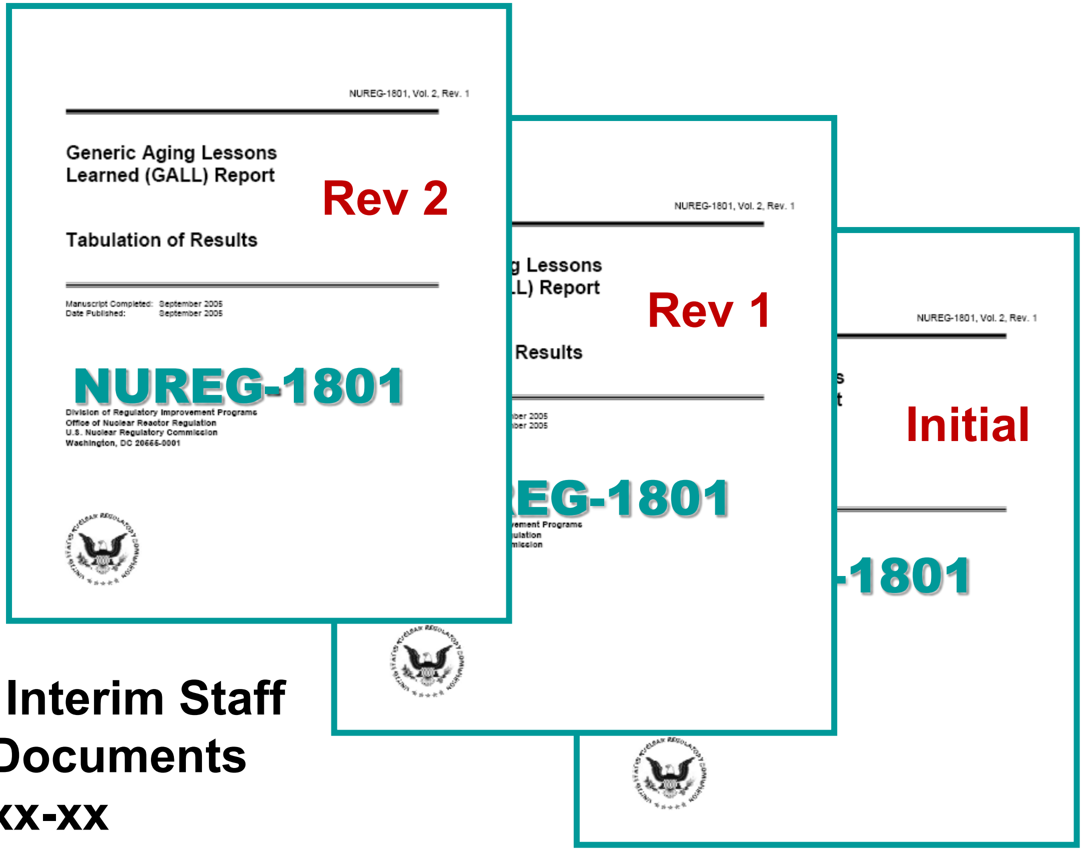
1. *Scope of Program*
2. *Preventive Actions*
3. *Parameters Monitored/Inspected*
4. *Detection of Aging Effects*
5. *Monitoring and Trending*
6. *Acceptance Criteria*
7. *Corrective Actions*
8. *Confirmation Process*
9. *Administrative Controls*
10. *Operating Experience*

Developing & Maintaining
Effective Aging Management Programs (AMP)



Use of Corrective Action, Operating Experience
and ongoing research ensures existing AMPs remain effective for SLR

Guidance Documents Updated Regularly



Industry Guidance:
Application Format and Content Updated
Lessons Learned
NEI 95-10 Rev 6 (RG1.188)

Ten Active Interim Staff Guidance Documents
LR-ISG-20xx-xx
23 Previous closed ISGs

Plant Inspection for Aging Management

- NRC IP 71002 LR Site Inspections
- NRC IP 71003 Post Approval Inspections
- Aging management part of normal NRC site inspection procedures and included in ROP
- SLR Audits, Nine Mile, Ginna, Robinson
  - No major deficiencies

Detailed Analysis of SECY Paper

Key Principles for License Renewal

- **Current regulatory process** is adequate to ensure that the licensing basis of all operating plants provides and maintains an **acceptable level of safety** so that operation will not be detrimental to public health and safety or common defense and security
- Each plant's licensing basis is required to be **maintained during any renewal term** in the **same manner and to the same extent** as during the original licensing term

Agree with DLR Staff Conclusions for Four Items

- License renewal process and regulations are sound and can support subsequent license renewal
- Environmental issues can be adequately addressed by the existing generic environmental impact statement (GEIS)
- Helpful for the NRC to revise its license renewal guidance (GALL, SRP) but not essential
- No need for applicants to include PRA update because no unique nexus to SLR

Overall Concerns with Rulemaking

- Out of step with "Implementation of the Cumulative Effects of Regulation Process Changes" (SECY-12-0137)
- No significant issue, inspection finding, audit report, implementation difficulty, or operational need to implement rulemaking
- SECY claims of improved efficiency or "more predictable review process" not backed up with any cost-benefit justification or study
- Most changes suggested in SECY not unique to SLR and can be implemented without rulemaking
- For these non-safety significant issues, schedule for rulemaking may impact industry plans and NRC staff resource requirements for SLR application reviews

Summary of SECY Proposed Changes

- NRC Staff Proposed 4 Options (SECY -14-0016):
  - # 1 – No change to existing 10 CFR 54 regulations
  - # 2 – Minor clarifications to 10 CFR 54 for LR and SLR
    - Editorial update to 10 CFR 54.4(a)(3) to Reference 10 CFR 50.61a (PTS)
    - Clarify Intent of 10 CFR 54.37(b) (NRC updates)
  - # 3 – Update 10 CFR 54 for LR and SLR
    - Define expectations of Timely Renewal (10 CFR2.109)
    - Revise 10 CFR 54.4(a)(3) to place 10 CFR 50.54(hh) and FLEX equipment in scope of LR
  - # 4 – Rulemaking for subsequent renewal-specific changes
    - Require that Licensees effectively maintain License Renewal activities and report aging-related degradation after a license is renewed
    - Limit the time during which SLR applications can be filed
    - Require verification of continuing validity of certain original design parameters

Option 1 – 10 CFR 54 is sound

- Part 54 anticipates further rounds of License Renewal
- Existing regulatory processes ensure safe operation
  - 10 CFR 50, Appendix B
  - Aging Management Programs (AMPs)
  - Maintenance Rule
  - ROP process
  - Design basis is maintained
- Process proven through vast experience, 73 renewed licensed, 27 reactor units in PEO
- Reliable, predictable process

Option 2- Unnecessary Editorial Changes

- "These changes alone may not warrant resource allocation to conduct the rulemaking process" (SECY pg. 6)
- 54.37(b) can be further clarified in a Regulatory Issue Summary (RIS) if necessary
- Would apply to current renewals

Option 3 – Unnecessary and No Unique Relevance to SLR

- Timely Renewal – Unnecessary Regulation
  - Rare event – one time
  - NRC Inspection Procedure 71013
  - Addressed through current processes
- Commission considered EP equipment in LR rule not in scope (SOC)
- 50:54(hh)(2) equipment and FLEX equipment managed by plant procedures.
- Would apply to current renewals

Option 4 – Conflicts with Fundamental Regulatory Principles in LR Rule

I. "Explicitly require maintenance of effectiveness … and reporting age-related degradation."

- Existing regulatory guidance, GALL review items
  - **5. *Monitoring and Trending***
  - **10. *Operating Experience***
- Required by 10 CFR 50, Appendix B
  - XVI. Corrective Action

Measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition. The identification of the significant condition adverse to quality, the cause of the condition, and the corrective action taken shall be documented and reported to appropriate levels of management.

Option 4 – Current Industry Initiatives Underway

- Current industry initiatives underway
  - “Use of Industry Operating Experience for Age-Related Degradation and Aging Management Programs” NEI 14-xx
  - “Aging Management Program Effectiveness” NEI 14-xx
- Not an SLR specific issue – if important, why wait 15 to 20 years to implement

Option 4 – Significant AMP Experience

II. Limit the Time During Which SLR Applications Can Be Filed (<20 Years)

- Many Aging Management Programs in place from beginning of plant operation
  - Program improvements made based on OE and research programs (EPRI, DOE)
  - Industry Initiatives – Buried Piping Program
- Significant AMP experience in PEO will be available across industry before 1st SLR application is submitted (>40 Reactor-years in PEO now)
- Due to significant economic uncertainty, 20 year planning horizon should be maintained

Option 4 – Validate Original Design Parameters

- Undermines the two principles of License Renewal
- Matter of current plant operation and addressed through existing NRC Regulatory Processes
- Wasteful and inefficient to address in the SLR process and adding to cumulative effects of unnecessary regulations

Summary

- The future of US license renewal depends on certainty in the regulatory process
- Existing License Renewal regulation provides a solid foundation for safe operation
- SLR Schedule is tight compared to first round of license renewals and may be compromised by SLR Rulemaking
- Criteria for rulemaking is not supported by increase in safety nor efficiency improvements

ELECTRIC POWER RESEARCH INSTITUTE

EPRI Long Term Operations Program R&D for Aging Management

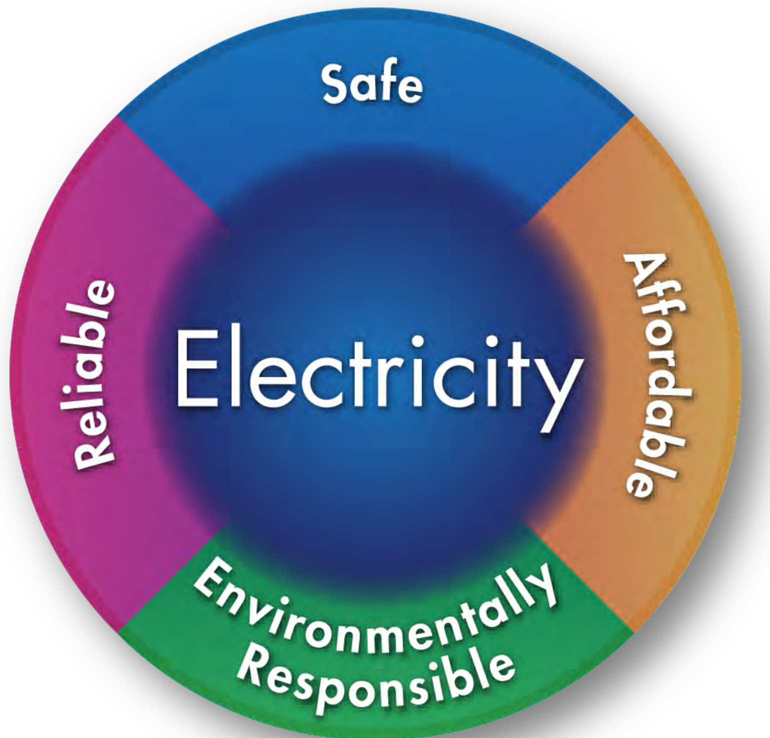
Sherry Bernhoft
EPRI, Program Manager

ACRS
Plant License Renewal Subcommittee Meeting
April 8, 2014

Together…Shaping the Future of Electricity

EPRI's Mission

To conduct research, development and demonstration on key issues facing the electricity sector on behalf of our members, energy stakeholders, and society



Three Key Aspects of EPRI

Independent
Objective, scientifically based results address reliability, efficiency, affordability, health, safety and the environment

Nonprofit
Chartered to serve the public benefit

Collaborative
Bring together scientists, engineers, academic researchers, industry experts

Nuclear Sector Core Drivers

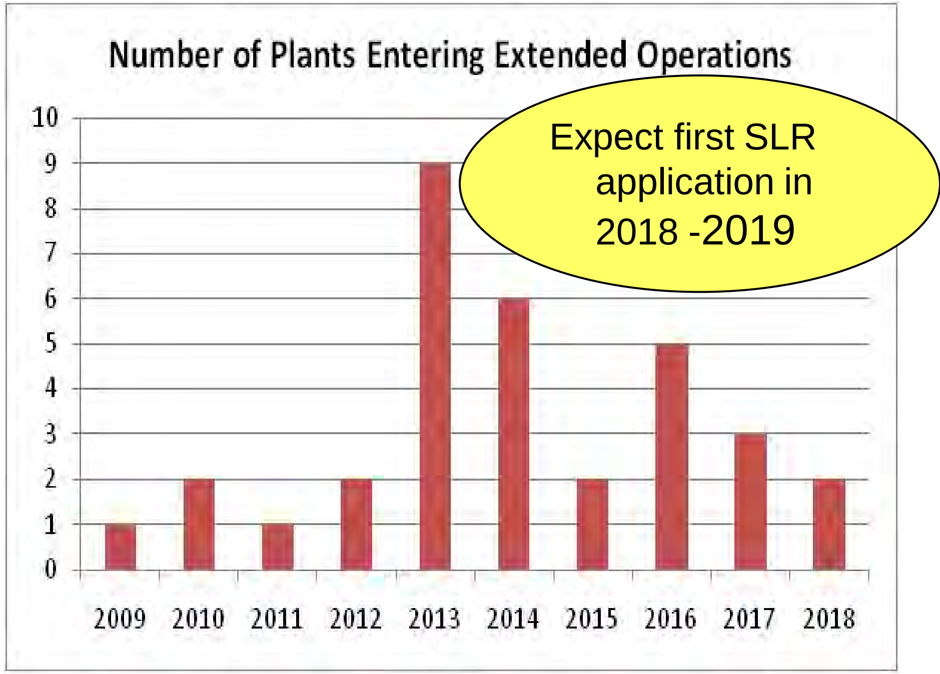
Maximize the safe utilization of existing nuclear assets

Enable the deployment of advanced nuclear technologies

Long-term sustainability of nuclear energy

EPRI LTO Program Goals and Objectives

- Technical basis for safe, reliable plant operation through extended lifetime
- Demonstrated technologies to support long-term plant management
- Research projects integrated with other EPRI programs
- External collaboration: DOE, NRC Research, EDF, NEI, Owners Groups and IAEA



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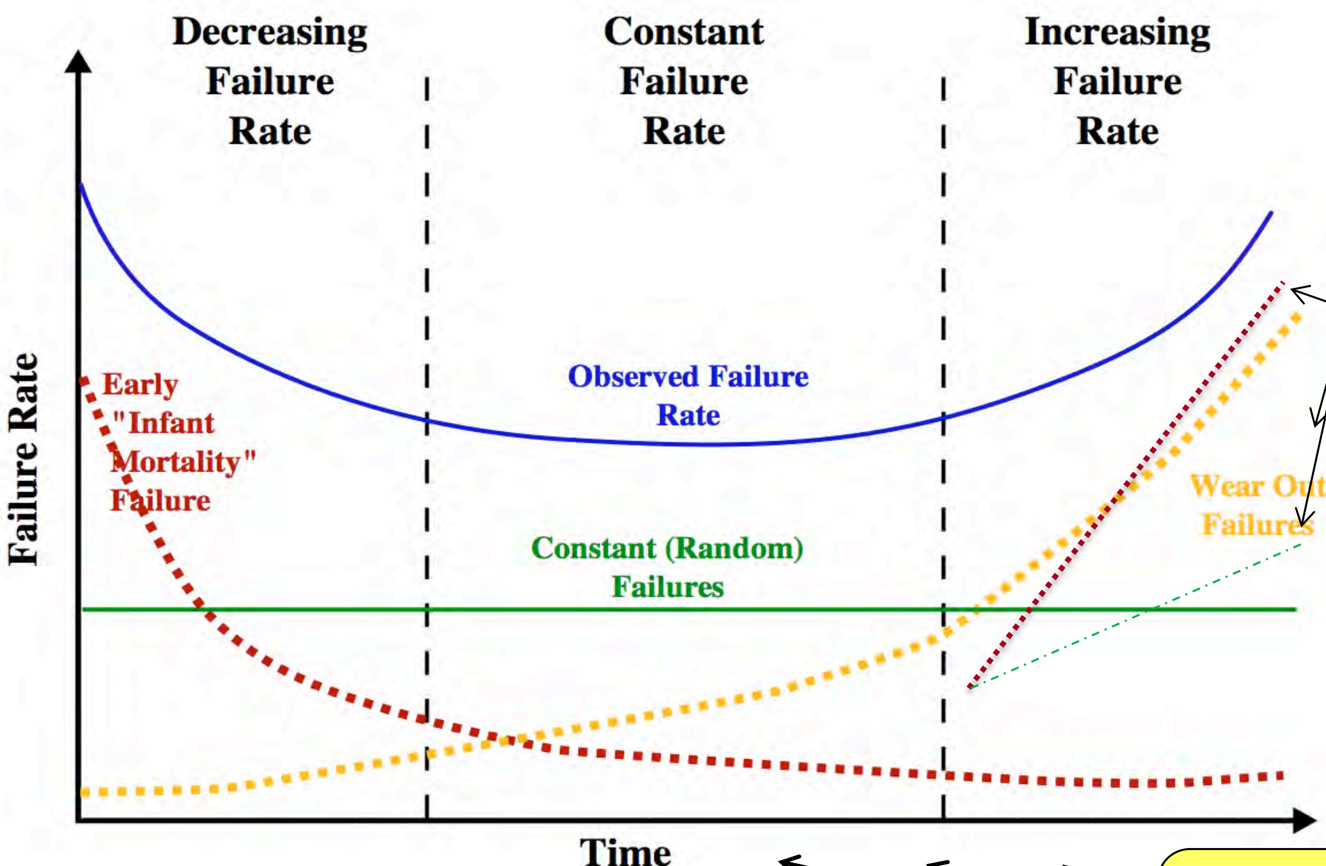
Aging Management



- Rate of damage will set inspection intervals & replacement timing

- Development of mitigation strategies

Typical Bathtub Curve *(source: Wikipedia)*

What happens with long-term operations?

Basis for Implementation of Aging Management

- R&D to understand aging degradation
  - Mechanism and failure modes
  - Initiation and growth rates
  - Inspection and Evaluation GLs

- Inspection methods
  - Detection and measurement
  - Non destructive examination and qualification

- Mitigation strategies
  - Chemistry
  - Stress relieving techniques
  - Weld overlays

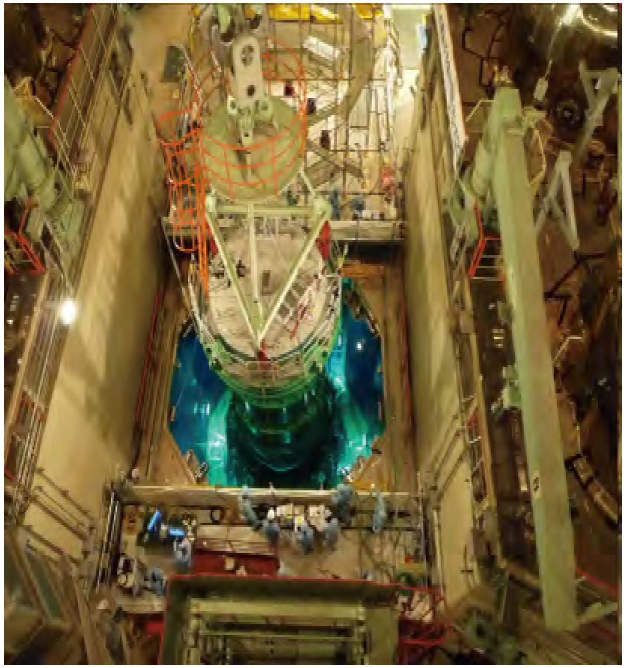
- Condition Monitoring
  - On-line monitoring
  - In-field detection

- Prediction of Remaining Useful Life
  - Health Monitoring software and algorithms

- Repair & Replacement Decisions
  - Life Cycle Management GLs
  - Advanced welding for irradiated materials
  - Integrated Life Cycle Management (ILCM)

EPRI LTO R&D Focus Areas

- **Aging Management**
  - **Primary system metals, welds and piping**
  - **Reactor pressure vessel**
  - **Steam Generators**
  - **Electrical cables**
  - **Concrete and containment structures**
  - **Buried piping**
  - **Coatings**
  - **Flow Accelerated Corrosion (FAC)**
- *Opportunities for Modernization*
  - *Advanced Instrumentation & Controls*
  - *Advanced risks and PRA*
  - *Advanced welding for irradiated materials*
  - *Non-destructive testing methodologies (NDE)*
- *Enabling technologies*
  - *Pilot plant projects and demonstrations*
  - *Integrated Life Cycle Management*



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EPRI R&D Projects – Cross Referenced to GALL, Rev 2

- **EPRI Report 3002000576**
  "Assessment of R&D Supporting Aging Management Programs for Long-Term Operations"

- Report cross-references the EPRI R&D Projects to the AMPs

- Three categories of AMPs
  - On-going long-term R&D
  - Established Programs
  - One-time plant specific inspections

Examples:

- On-going long-term R&D (8)
  - Effects of irradiation
  - Thermal effects
  - Reactor Pressure Vessel embrittlement
- Established Programs (20)
  - Chemistry
  - Steam Generator Inspections
  - FAC
- Plant Specific (22)
  - Fuel oil
  - Fire Protection System

Category 1 Summary – On-Going R&D for LTO

GALL AMP ID	AMP Name	Potential LTO Impact on AMP
XI.M9	BWR Vessel Internals	Irradiation and environmental effects on material performance
XI.M11B	Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components	Environmental effects on material performance
XI.M12	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	Thermal aging and possible irradiation effects on material performance
XI.M16A	PWR Vessel Internals	Irradiation and environmental effects on material
X.M31	Reactor Vessel Surveillance	Neutron fluence on reactor pressure vessel materials
XI.S6	Structures Monitoring	ASR susceptibility and irradiation effects on material properties
XI.E1	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Combined effects of thermal and radiation exposure
XI.E2	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used In Instrumentation Circuits	Combined effects of thermal and radiation exposure

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R&D for Aging Management

Category 1 Aging Management Programs:

- BWR Vessel Internals
- Cracking of Ni-Alloys
- Thermal Aging of CASS
- PWR Vessel Internals
- Reactor Pressure Vessel Surveillance
- Electrical Cables
- Concrete and Containment Structure

RCS Metals

Industry Materials Issue Management

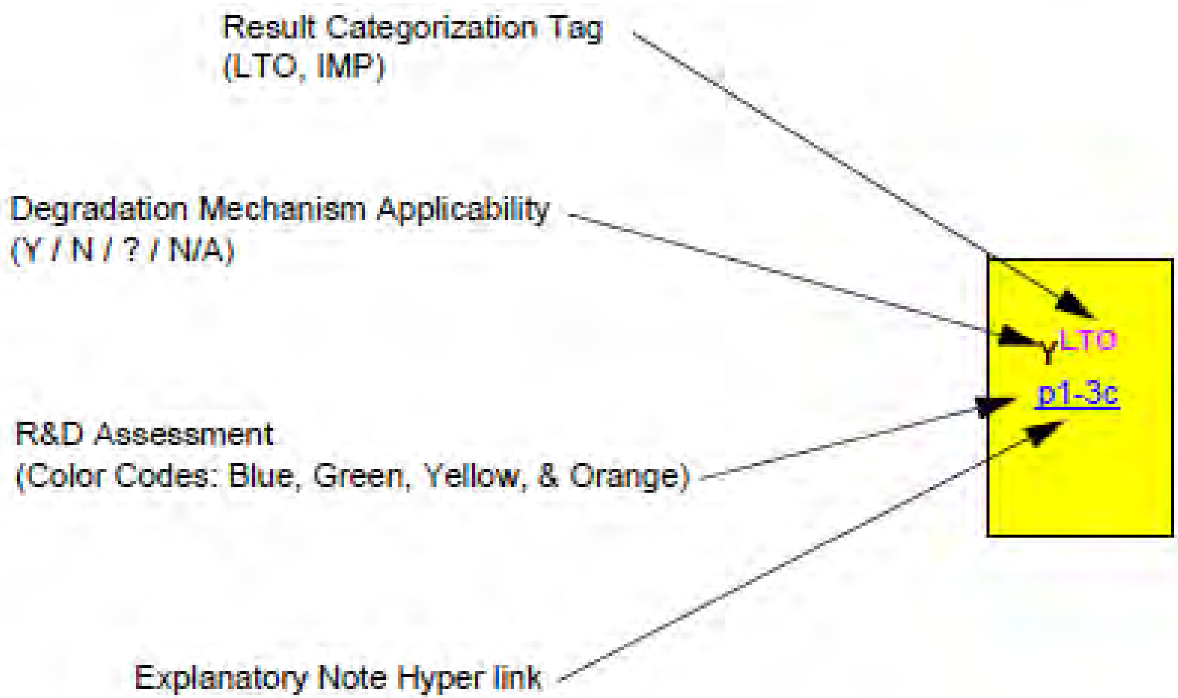
- Industry spends > $50M per year on Materials
- Industry Initiative NEI 03-08
  - Proactive management of material degradation issues
  - Communication of OE to Industry and NRC
- EPRI Program Areas:
  - BWR Vessels Internal Program (BWRVIP)
  - Materials Reliability Program (MRP – for PWRs)
  - Steam Generator Management Program (SGMP)
  - Non-Destructive Examination Program (NDE)
  - Primary System Corrosion Research (PSCR)
  - Water Chemistry Control
  - Welding & Repair Technology (WRTC)
- Extensive International collaboration

Integrated Materials Issues Strategic Plan

- Systematic Approach to Managing Materials
  - Identify vulnerabilities
  - Assess condition (inspect & evaluate)
  - Mitigate degradation mechanism
  - Repair or replace as required
- Approach Used:
  - Materials Degradation Matrix (MDM) and Issue Management Tables (IMTs)
  - Updated on a routine frequency
  - Expert solicitation

In 2010 LTO 'Flags' were added to the MDM

Color Chart Presentation of MDM Results



Blue	lack of data to establish degradation applicability
Green	well characterized, little or no additional research is needed
Yellow	ongoing R&D efforts to resolve uncertainties in near-term time frame
Orange	insufficient R&D to resolve uncertainties in a near-term time frame

Example MDM Results-- BWR Reactor Internals

Table 4-2: BWR Reactor Vessel Internals

MATERIAL	DEGRADATION MODE													
	Corrosion				Wear	SCC		Fatigue		Reduction in Fract Properties		Irradiation Effects		
	Wstg	Pitting	FAC	Foul	Wear	IG/TG	IA	HC	EAF	Th	Env	Emb	VS	IC / SR
STRUCTURAL COMPONENTS & WELDS														
SS: 300 Series Base Metal & HAZ	N	N	N	Y b2-4a	Y^{IMP} b2-5a	Y b2-6a	Y^{LTO} b2-7a	Y^{IMP} b2-8a	Y^{LTO} b2-9a	N	Y b2-11a	Y b2-12a	N	Y b2-14a
SS: Welds & Clad	N	N	N	Y b2-4b	Y^{IMP} b2-5b	Y b2-6b	Y^{LTO} b2-7b	Y^{IMP} b2-8b	Y^{LTO} b2-9b	Y b2-10b	Y b2-11b	Y b2-12b	N	Y b2-14b
Cast Austenitic Stainless Steel	N	N	N	N	N	Y b2-6c	Y^{LTO} b2-7c	Y^{IMP} b2-8c	Y^{LTO} b2-9c	Y^{IMP} b2-10c	Y b2-11c	Y^{LTO} b2-12c	N	N
Ni-Alloy: A600 Base Metal & HAZ	N	N	N	N	N	Y^{LTO} b2-6d	N	Y^{IMP} b2-8d	Y^{LTO} b2-9d	N	Y b2-11d	N	N	N
Ni-Alloy: A182 Welds & Clad	N	N	N	N	N	Y^{LTO} b2-6e	N^{LTO} b2-7e	Y^{IMP} b2-8e	Y^{LTO} b2-9e	N	Y b2-11e	N	N	N
Ni-Alloy: A82 Welds & Clad	N	N	N	N	N	Y^{LTO} b2-6f	N^{LTO} b2-7f	Y^{IMP} b2-8f	Y^{LTO} b2-9f	N	Y b2-11f	N	N	N
FASTENERS & HARDWARE														
SS: 300 Series	N	N	N	N	N	Y b2-6g	Y b2-7g	Y^{IMP} b2-8g	Y^{LTO} b2-9g	N	Y b2-11g	Y b2-12g	N	Y^{IMP} b2-14g
SS: XM-19	N	N	N	N	N	Y b2-6h	Y^{LTO} b2-7h	Y^{IMP} b2-8h	Y^{LTO} b2-9h	N	Y b2-11h	Y^{LTO} b2-12h	N	Y^{LTO} b2-14h
Ni-Alloy: X-750	N	N	N	N	N	Y b2-6i	Y^{LTO} b2-7i	Y^{IMP} b2-8i	Y^{LTO} b2-9i	N	Y b2-11i	Y^{LTO} b2-12i	N	Y^{LTO} b2-14i

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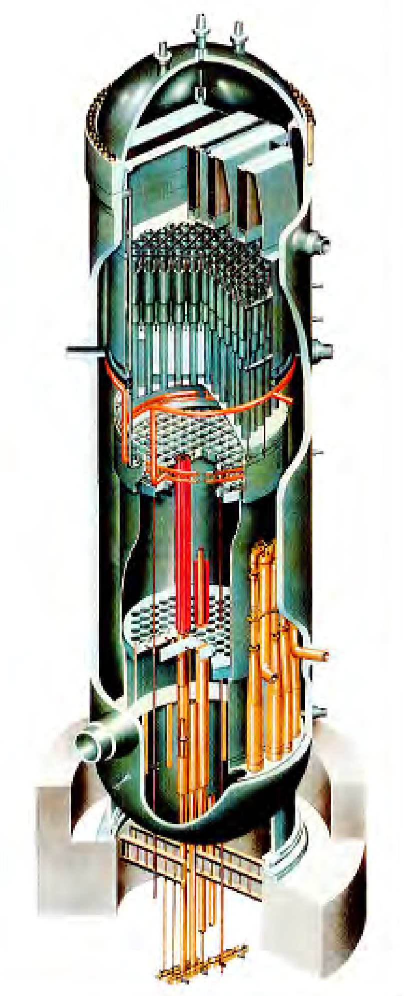
Materials Degradation Issues Identified for LTO

- Increased neutron fluence effects
  - RPV embrittlement
  - Core internals
    - Threshold stress for IASCC initiation
    - Reduction in toughness proprieties
    - Void swelling
  - Impact on core periphery materials (fluence and temperature)
- Late life Stress Corrosion Cracking (SCC) initiation
- Fatigue usage
  - Increased fatigue cycles
  - Environmental effects on fracture properties

XI.M9 BWR Vessel Internals

- BWR Vessel Internals Program (BWRVIP)
- Issue: Prediction of SCC initiation and growth trends with increased neutron fluence and exposure to the environment
- BWRVIP is ***a living issue program*** with utility and OEM (GE) membership
  - Extensive R&D has been completed on modeling and understanding IASCC in the BWR environment
  - The AMP on reactor internals references 32 BWRVIP documents
  - BWRVIP documents are updated based on Operating Experience, inspection results and research



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BWRVIP Guidelines to Manage Degradation

Component	Assessment (I&E) Guidelines	Inspection Guidelines	Repair/Replace Design Criteria	Mitigation Recommendations
Core shroud	BWRVIP-76, R1	BWRVIP-03	BWRVIP-02-A/-04-A	BWRVIP-62, R1/-190
Core spray	BWRVIP-18, R2	BWRVIP-03	BWRVIP-16-A/-19-A/-34	N/A
Shroud support	BWRVIP-38	BWRVIP-03	BWRVIP-52-A	BWRVIP-62, R1/-190
Top Guide	BWRVIP-26-A	BWRVIP-03	BWRVIP-50-A	N/A
Core Plate	BWRVIP-25	BWRVIP-03	BWRVIP-50-A	BWRVIP-62, R1/-190
SLC	BWRVIP-27-A	BWRVIP-03	BWRVIP-53-A	BWRVIP-62, R1/-190
Jet pump assembly	BWRVIP-41	BWRVIP-03	BWRVIP-51-A	BWRVIP-62, R1/-190
CRD guide/stub tube	BWRVIP-47-A	BWRVIP-03	BWRVIP-17/-55-A/-58-A	BWRVIP-62, R1/-190
In-core housing/dry tube	BWRVIP-47-A	BWRVIP-03	BWRVIP-17/-55-A	BWRVIP-62, R1/-190
Instrument penetrations	BWRVIP-49-A	BWRVIP-03	BWRVIP-57-A	BWRVIP-62, R1/-190
LPCI coupling	BWRVIP-42-A	BWRVIP-03	BWRVIP-56-A	N/A
Vessel ID brackets	BWRVIP-48-A	BWRVIP-03	BWRVIP-52-A	BWRVIP-62, R1/-190
Reactor pressure vessel	BWRVIP-74-A	N/A	N/A	N/A
Primary system piping	BWVIP-75-A	N/A	N/A	BWRVIP-62, R1/-190
Steam dryer	BWRVIP-139-A	BWRVIP-03	BWRVIP-181	N/A
Access hole cover	BWRVIP-180	BWRVIP-03	TBD	BWRVIP-62-, R1-190
Top guide grid beam	BWRVIP-183	BWRVIP-03	BWRVIP-50-A	N/A
Bottom head drain line	BWRVIP-205	N/A	BWRVIP-208	N/A

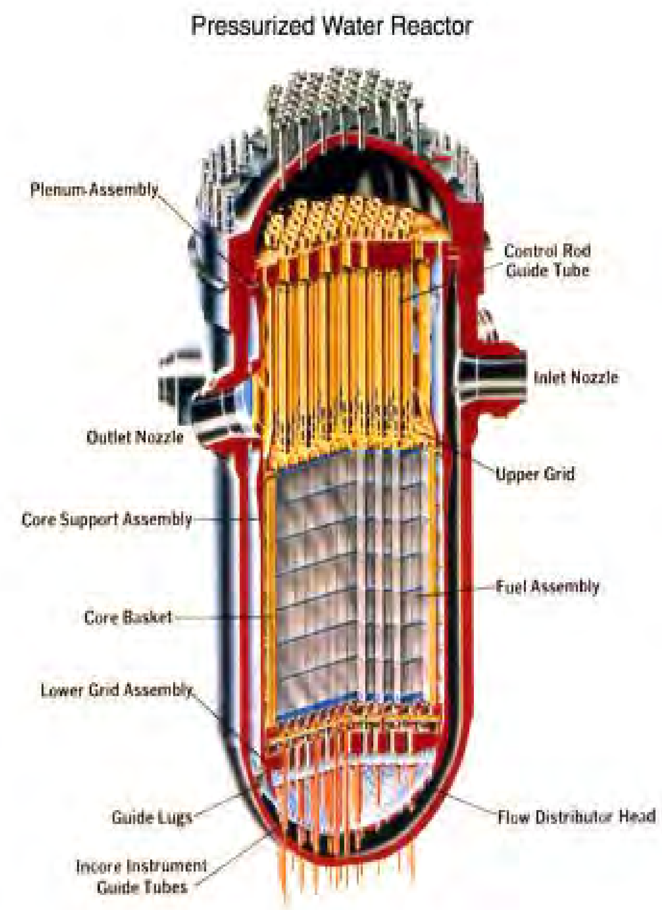
BWRVIP Ongoing and Future Efforts

- Continued international collaboration to develop fundamental mechanistic understanding of IASCC
  - Reduce uncertainties in current modeling
  - Improved correlations for crack-growth rate studies
  - Continued support for mitigation, repair and replacement strategies
- Harvesting of materials from retired plants to assess fracture toughness
  - Zorita materials work is co-funded with NRC Research
- Plant shroud material sample testing

The BWRVIP technical reports are updated based on OE, inspection results and research

XI.M11B Cracking of Ni-Alloy

- Materials Reliability Program (MRP)
- Issue: PWR nickel-alloy cracks and boric acid that may leak from such cracks
- MRP ***is a living issue program*** with utility membership. Work is reflected in the ASME Section XI Code Cases:
  - N-722: Visual examinations
  - N-729-4: RPV head penetration examination
  - N-770-2: PWR butt-weld examinations
- MRP has assessed the impacts of leakage on wastage rates
- NDE technique has been developed for head penetrations
- MRP reports have have been published covering the crack-growth rate models and incorporated into the ASME Code, Section XI



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Ongoing/Future Efforts on Ni-Based Alloys

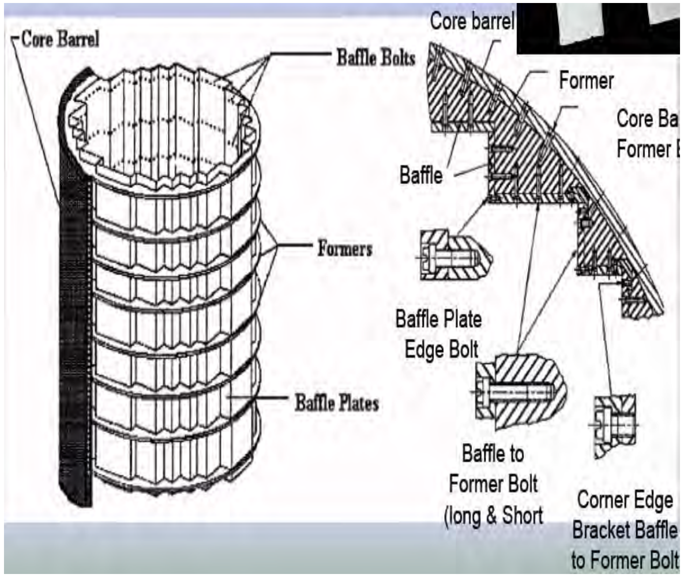
- Future updates on crack-growth rate models
- Peening is available as a mitigation tool for PWSCC
- Bottom mounted nozzle (BMN) work continues including evaluation of a plant boat sample
- Future R&D on BMN inspection technology
- Alloy 690 initiation and cracking testing

R&D will continue to provide additional insights to refine the crack growth rate models

XI.M12 Thermal Aging Embrittlement of CASS

- Issue: Thermal aging of pipe and components outside RPV
- Irradiation embrittlement is addressed for the PWRs under XI.16A and BWRs under XI.M9 internals aging management programs
- EPRI technical reports for aging management of CASS
  – Thermal Aging in PWRs
  – Thermal Aging and Neutron Embrittlement
  – Flaw Tolerance Evaluation for CASS
- A joint BWRVIP-MRP working group formed to address:
  – Screening criteria
  – Evaluate uncertainties
  – Evaluate fracture parameters
  – Interacting with the NRC staff on guidance development

XI.M16A PWR Vessel Internals



- Materials Reliability Program
- Issue:
  Prediction of IASCC and void swelling with increased fluence levels
- MRP-227-A provides a comprehensive examination program for PWR internals
  - Evaluation acceptance criteria methodology in WCAP-17096
  - Not formally in the GALL report but the NRC has developed an Interim Staff Guidance
- Supporting MRP reports:
  - Model for IASCC
  - Thermal Aging and Neutron Embrittlement Assessments
  - Void Swelling Studies

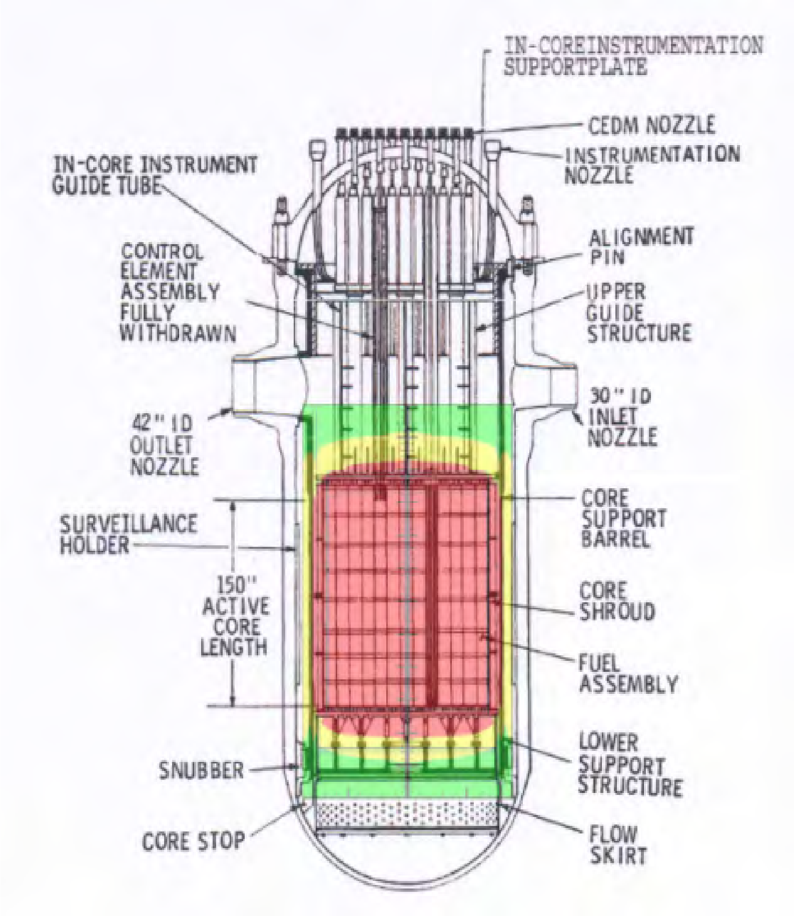
Ongoing/Future Efforts on PWR Internals

- Revision to MRP-227-A to incorporate additional research results, new guide card wear criteria and initial round of inspection results
- Zorita harvested materials testing
- GONDOLE void swelling
- Halden crack-growth rate work
- IASCC testing on Baffle Former Bolts

MRP reports based on R&D and OE exists to provide the technical basis for Aging Management and are in the NRC ISG

XI.M31 Reactor Vessel Surveillance

- Issue: Need to monitor fracture toughness of the RPV and nozzles due to irradiation
- BWRVIP Integrated Surveillance Program (ISP)
- MRP reports:
  - RPV Integrity Primer
  - Embrittlement Trend Correlation Master Curve
  - Static Tensile Testing of Pressure Vessel



Ongoing/Future Efforts on RPV

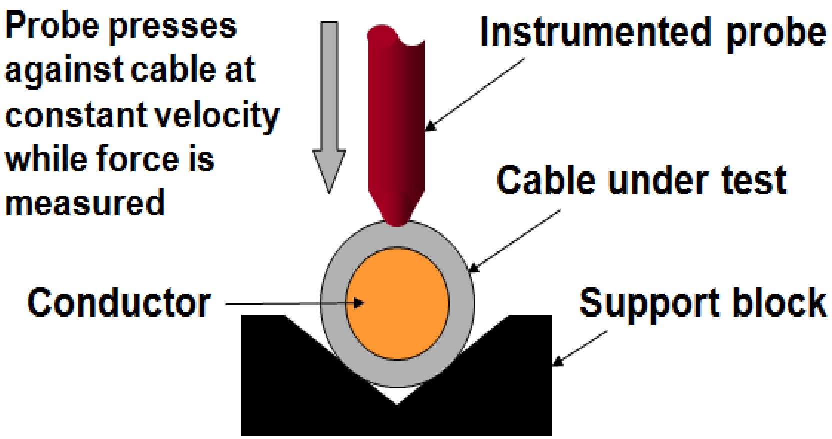
- Extension or replacement of the BWR ISP
- PWR Coordinated RV Surveillance Program
- PWR Supplemental Surveillance Program (PSSP)
- Atomic Probe Tomography test of irradiated samples
- MRP and PWROG will evaluate:
  - Impacts for components in the extended beltline weld region

EPRI reports based on R&D and OE exists to provide the technical basis for Aging Management

Electrical Cables

XI.E1 and XI.E2 Insulation Materials for Cables

- EPRI Plant Engineering
- Issue: Thermal and radiation exposure of the cable insulation materials
- EPRI Cable Aging Management is a ***living issue program*** with previous extensive R&D efforts on cable aging management
  - License Renewal Electrical Handbook
  - Cable Aging Reports
  - MV Aging Management Guidelines
  - Life Cycle Management Planning Source Books
  - Multiple reports on results of forensic testing on reported cable failures



Ongoing/Future Efforts for Cable R&D

- Presentation to NRC on cable R&D for LTO – 4/30/2014
- Integrated DOE-LWRS, EPRI and NRC RES roadmap
- Submergence
  - On-going work based on operating experience
- Material degradation and harvesting of field aged cables
  - Developing harvesting guidelines
- Condition monitoring
- Improved life-time predictions
  - Correlation to actual in-plant temperature and radiation levels
- Develop guidelines for lead plant support with SLR
- Tool box for cable aging management

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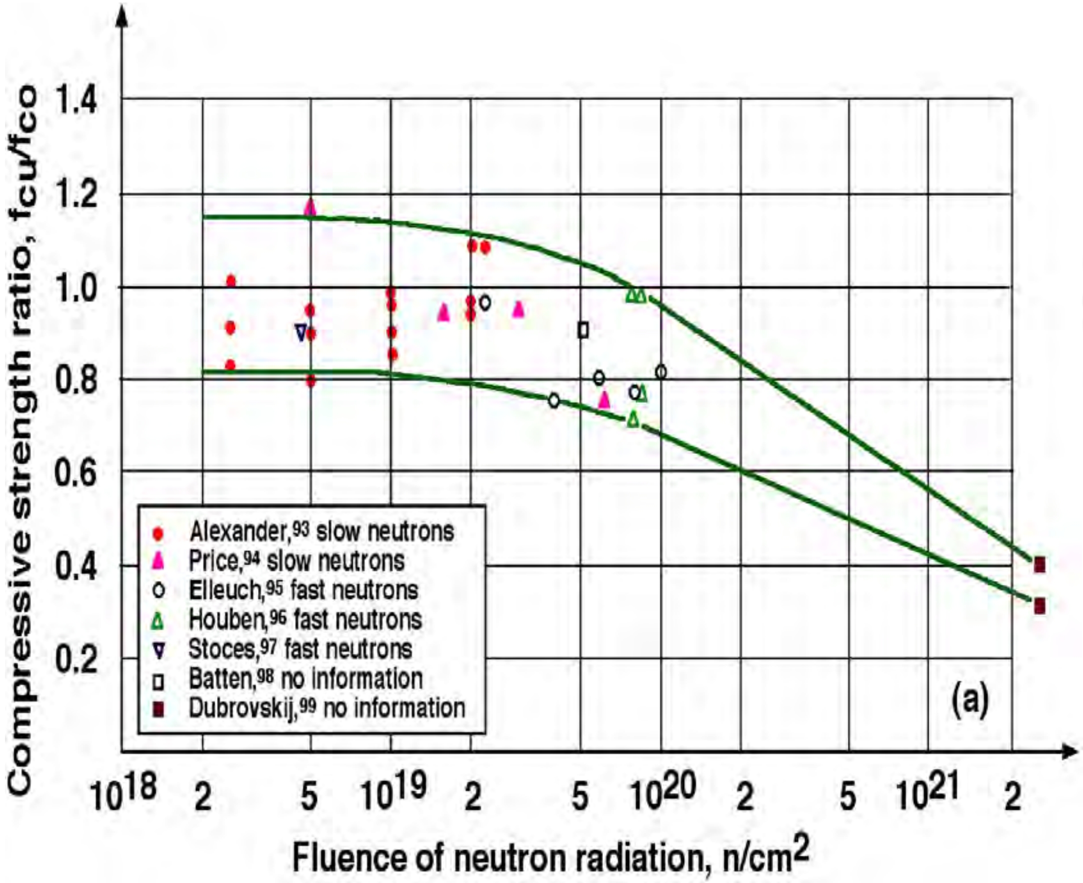
Concrete and Containment Structure

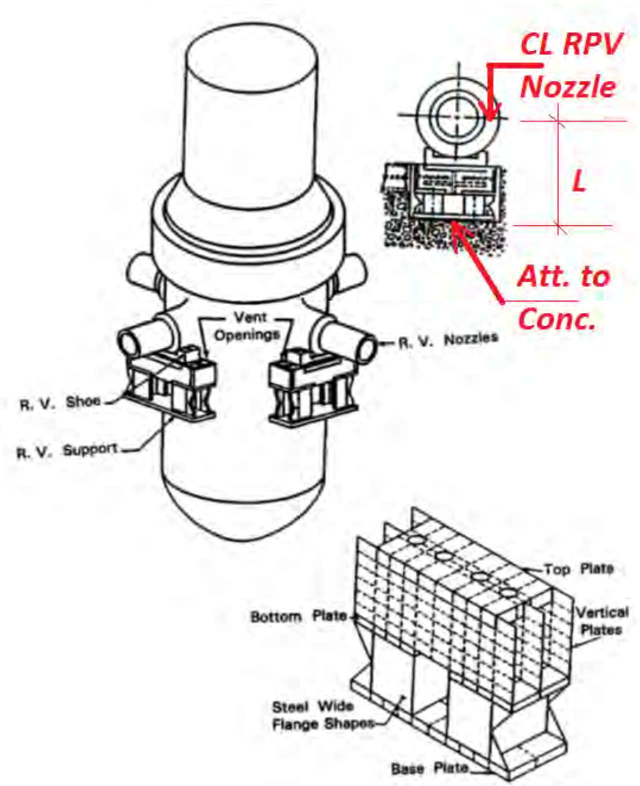
XI.S6 Structural Monitoring

- Concrete R&D for LTO presented to NRC December 2013
- 2010 prioritized Issue Management Table
- 2012 formed a utility member Advisory Group
- Issues:
  - Impact of Alkali silica reaction (ASR) on structural integrity
  - Impacts of irradiation and gamma heating
  - Creep
- Projects
  - Extensive data collection completed regarding irradiation effects on concrete
  - ASR technical support
  - Mechanistic model of Boric Acid attack on Spent Fuel Pools

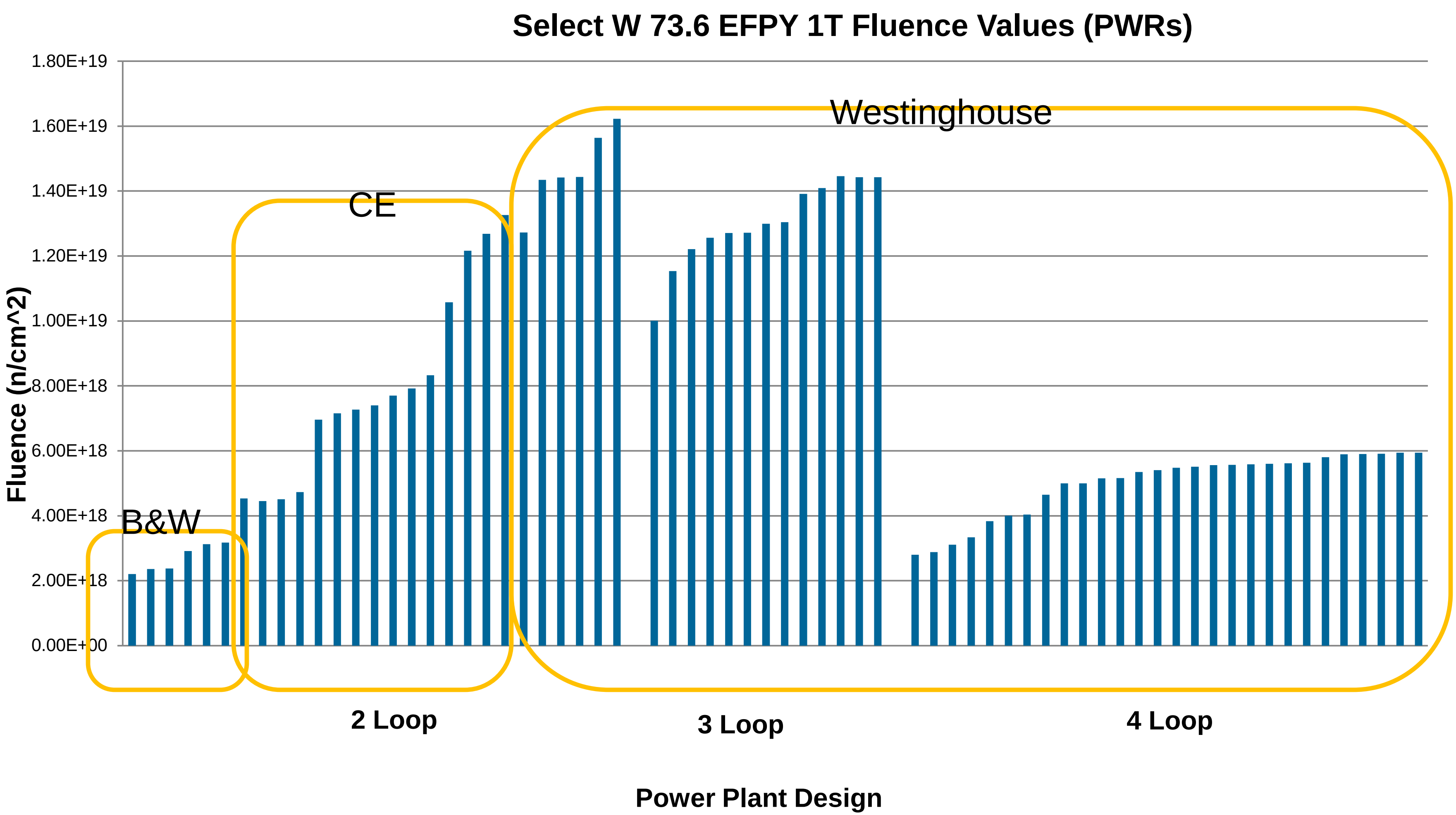
Irradiation Damage In Concrete – Previous Work

- Hilsdorf Curve – Effect of neutron irradiation on compressive strength





PWR 1T Fluence for 80 y Operation (E > 1 MeV)



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Ongoing/Future Efforts for Concrete R&D

- Integrated DOE-LWRS and EPRI Roadmap
- Alkali Silica Reactions (ASR)
  - Mapping of potential at-risk aggregates
  - Testing method and NDE development
  - LWRS has lead on mechanistic model and structural integrity
- Irradiation and gamma heating effects
  - Completed extensive literature search
  - Thermal and accelerated radiation testing in 2014
- Creep Fatigue
  - Large database from Department of Transportation
  - Application to NPP civil structures
- Boric Acid Impacts on SFPs
  - Mechanistic models of BA attach on concrete and rebar being developed
- Tool box for concrete and concrete structure repairs

R&D for Aging Management

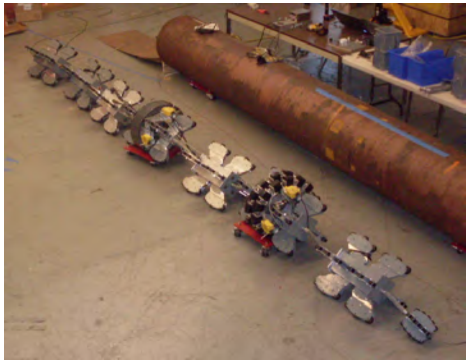
Category 2 Aging Management Programs - Examples:

- Steam Generators
- Buried and Underground Piping & Tanks
- Flow Accelerated Corrosion
- Water Chemistry

XI.M 19 Steam Generator Program

- Utilities are required by Technical Specifications to establish a steam generator program
  - All US utility programs are modeled after NEI 97-06 which references the following six EPRI SGMP guideline documents
    - Steam Generator Integrity Assessment Guidelines
    - Steam Generator In-Situ Pressure Test Guidelines
    - Steam Generator Examination Guidelines
    - Steam Generator Primary-to-Secondary Leak Guidelines
    - PWR Primary Water Chemistry Guidelines
    - PWR Secondary Water Chemistry Guidelines
- These guidelines incorporate a balance of prevention, mitigation, inspection, evaluation, repair and leakage monitoring
- These same 6 guidelines are referenced in the GALL (XI.M 19)

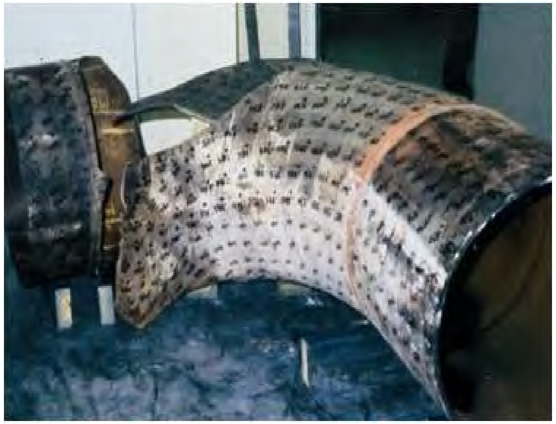
XI.M41 Buried and Underground Piping and Tanks



- Industry Initiative developed in response to operating experience
  - Implementation managed by NEI 09-14
- Utility Implementation
  - Programs developed
  - Inspections in progress
  - Long range asset management plans being developed
- Continuing EPRI R&D Projects (Buried Pipe, Tanks, Cathodic Protection, and Coatings)
  - Programmatic support and Guidance
  - Corrosion analysis
  - Inspection methodology advancements
  - Mitigation Strategies
  - Repair and replacement options

XI.M17 Flow Accelerated Corrosion (FAC)

- Industry Programs developed in response to operating experience
  - Implementation managed by NRC GL 89-08
  - Programmatic Guidance in EPRI NSAC-202L
- Utility Implementation
  - Mature Programs
  - Long history of Inspections
  - High Wear Systems replaced with resistant materials
  - Operating experiences shared in active industry user's group (CHUG)
- Continuing EPRI R&D Projects
  - Programmatic Optimization
  - Knowledge Transfer
  - FAC and Erosion analysis
  - Inspection methodology advancements



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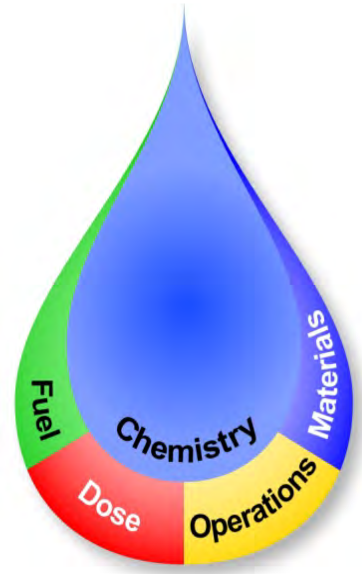
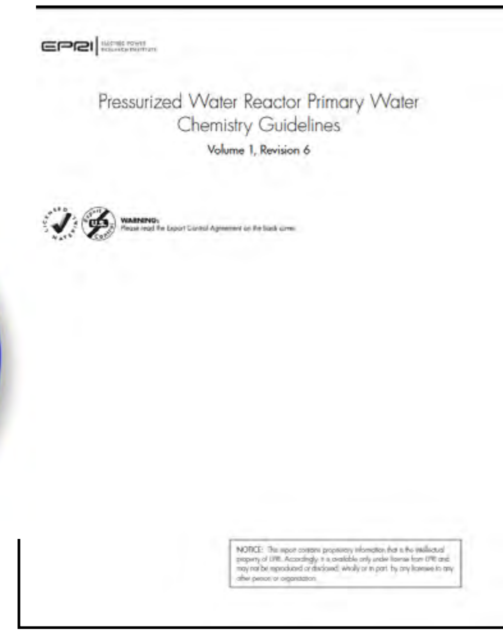
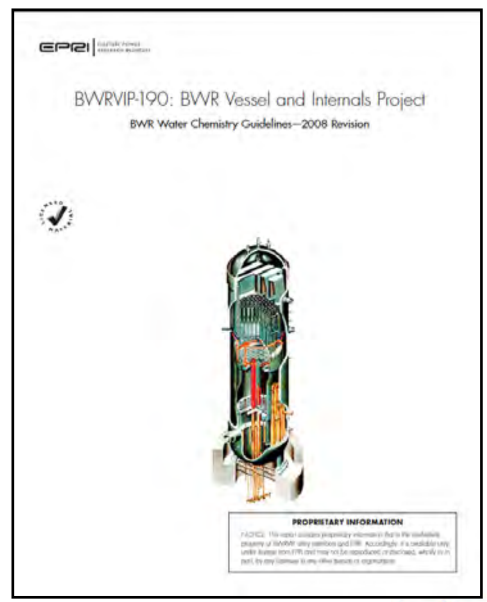
XI.M2 Water Chemistry

- Water Chemistry Guidelines are a part of NEI 03-08
- Goals:
  - Materials integrity and mitigations of corrosion
  - Fuel reliability and performance
  - Radiation dose control
  - Plant-specific optimization
- GL Updates and revisions
  - Based on operating experience, US and International
  - Recent R&D
  - Inspection results
  - Continuous improvements

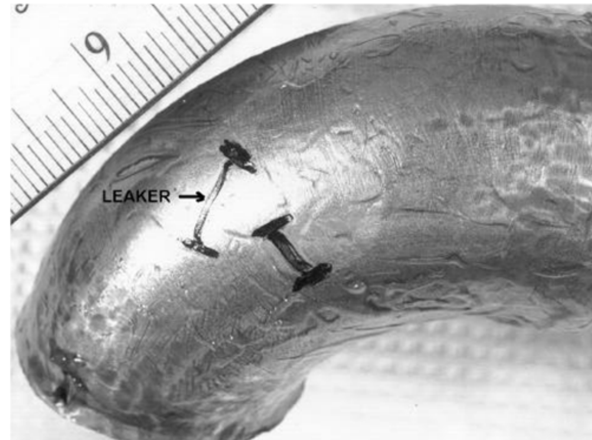


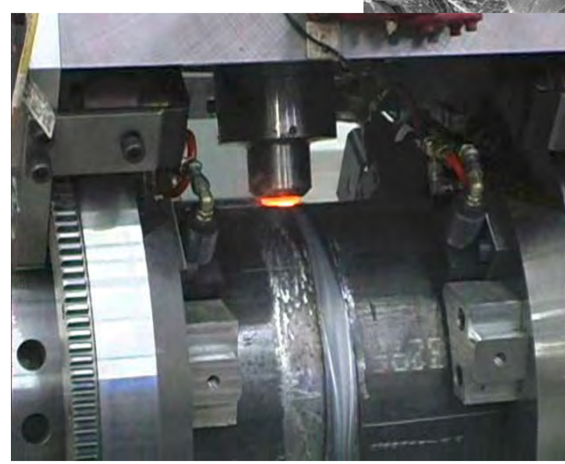

Pressurized Water Reactor Primary Water Chemistry Guidelines
Volume 1, Revision 6


BWRVIP-190: BWR Vessel and Internals Project
BWR Water Chemistry Guidelines—2008 Revision
PROPRIETARY INFORMATION

Summary – Technical Basis for Robust Aging Management

- R&D to understand aging degradation
- Inspection methods
- Mitigation strategies
- Condition Monitoring
- Prediction of Remaining Useful Life
- Repair & Replacement Decisions





Together…Shaping the Future of Electricity

U.S. DEPARTMENT OF ENERGY | Nuclear Energy

Light Water Reactor Sustainability (LWRS)

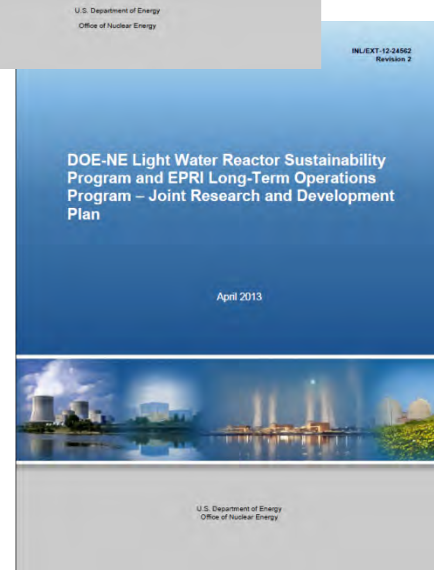
Richard Reister, LWRS Program Manager

Office of Light Water Reactor Technologies
Office of Nuclear Energy
U.S. Department of Energy

April 8, 2014

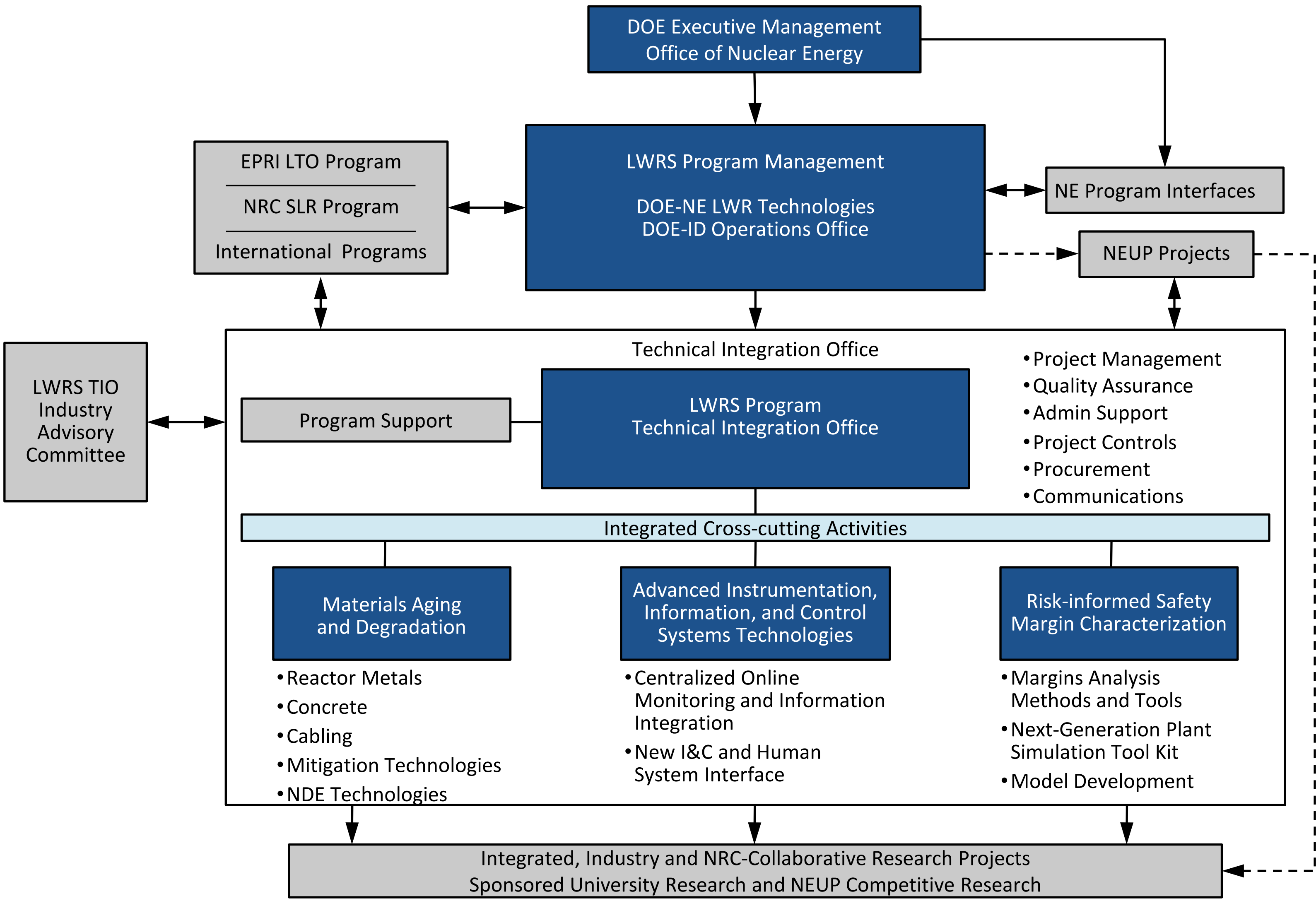
Goals and Objectives

- **NE R&D Objective**
  - Develop technologies and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors
- **Program Goals**
  - Develop the fundamental scientific basis to understand, predict, and measure changes in materials and systems, structures, and components (SSCs) as they age in environments associated with continued long-term operations of the existing reactors
  - Apply this fundamental knowledge to develop and demonstrate methods and technologies that support safe and economical long-term operation of existing reactors
  - Research new technologies to address enhanced plant performance, economics, and safety.



Program Plans Available on web site: inl.gov/lwrs

LWRS Program Organization



Advanced Instrumentation, Information, and Control (II&C) Systems Technologies

- Address long-term aging and reliability concerns of existing II&C technologies and develop and test new technologies
- Establish a strategy to implement long-term modernization of II&C systems.
- Need to develop the scientific and technical bases to support safe and efficient plant II&C modernization.

Risk-Informed Safety Margin Characterization (RISMC)

Margins Analysis Techniques

- Develop techniques to conduct margins analysis, including methodology for carrying out simulation-based studies of margin

Simulation components of the RISMC Toolkit

- RELAP-7
  - Systems code that will simulate behavior at the plant level
  - Advanced computational tools and techniques to allow faster and more accurate analysis
- Simulation Controller (RAVEN – Risk Analysis Virtual ENvironment)
  - Provides input on plant state to RELAP-7 (including operator actions, component states, etc.)
  - Integrates output from RELAP-7 with other considerations (e.g., probabilistic and procedures information) to determine component states
- Aging Simulation (Grizzly)
  - Component aging and damage evolution will be modeled in separate modules that will couple to RELAP-7 and RAVEN

Materials Aging and Degradation

- **Increased lifetime leads to increased exposures**
  - Time at temperature
  - Stress
  - Coolant
  - Neutrons
- **Extending reactor life to 60, 80 years or beyond may increase susceptibility and severity of known forms of degradation**
- **New mechanisms of materials degradation are possible**
- **Develop the scientific basis for understanding and predicting long-term environmental degradation behavior of materials in nuclear power plants – detect and characterize aging degradation processes**
- **Provide data and methods to assess the performance of systems, structures, and components essential to safe and sustained NPP operations**

U.S. DEPARTMENT OF ENERGY

Nuclear Energy

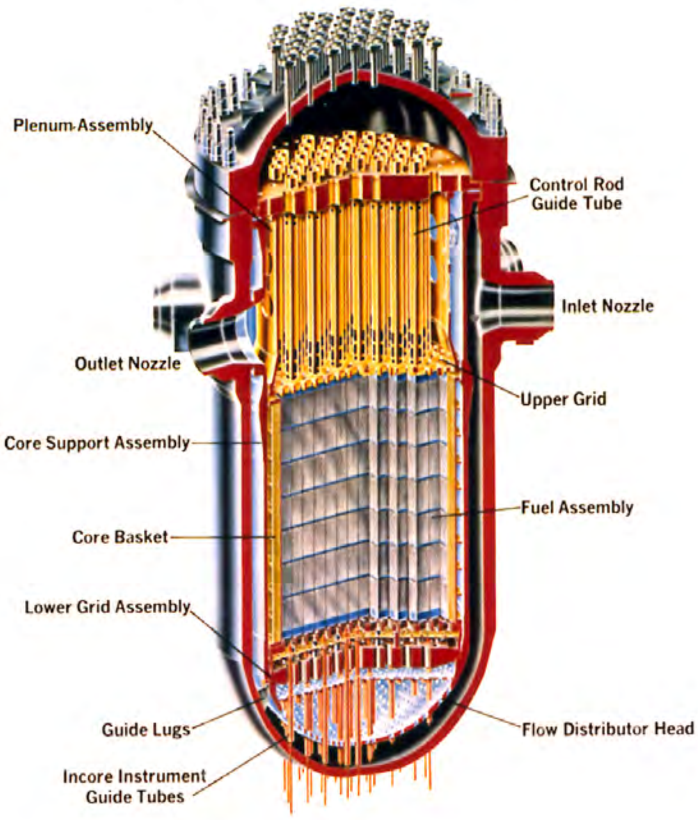
Assuring material performance under subsequent license renewal will require several key elements

- ***Measurements of degradation:*** High quality data will provide key information for mechanistic studies, but has value to regulators and industry on its own.
- ***Mechanisms of degradation*:** Basic research to understand the underlying mechanisms of selected degradation modes will lead to better prediction and mitigation.
- ***Modeling and simulation*:** Improved modeling and simulation efforts have great potential in reducing the experimental burden for life extension studies. These methods can help interpolate and extrapolate data trends for extended life.
- ***Monitoring*:** While understanding and predicting failures are extremely valuable tools for the management of reactor components, non-destructive monitoring must also be utilized.
- ***Mitigation strategies*:** While some forms of degradation have been well-researched, there are few options in mitigating their effects. New technologies may overcome limits of degradation in key components and systems.

Materials Aging and Degradation

- **Develop the scientific basis for understanding and predicting materials aging and degradation within components, systems, and structures**
  - Reactor metals (RPV's, internals, steam generators, balance of plant, and weldments)
    - Mechanisms of IASCC
    - High-fluence effects on RPV steel
    - Crack initiation in Nickel based alloys
  - Concrete
    - Concrete aging for long term operation
    - Monitoring tools for concrete
  - Cabling
    - Assessment of cable aging issues
  - Mitigation, repair, and replacement technologies
    - Weld repair techniques
    - Post irradiation annealing
    - Advanced replacement alloys

Pressurized Water Reactor



Materials Aging and Degradation Research to Support Long-Term Operation Decisions

Thomas. M. Rosseel and J. T. Busby

Oak Ridge National Laboratory

with a host of contributors

ACRS
Plant License Renewal Subcommittee Meeting
April 8, 2014

Light Water Reactor Sustainability R&D Program

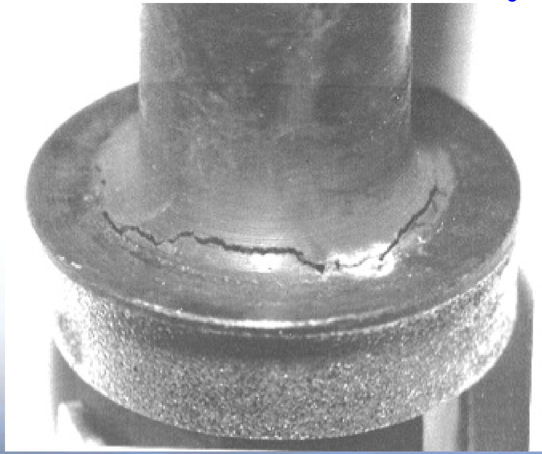
Presentation Outline:

- Materials Pathway overview
- Key activities within Materials Aging and Degradation pathway of the LWRS Program
- Partnerships
- Examples of research
  - Concrete
  - Cabling
  - Metals
  - Weld Repair
  - Integrated Research

LWRS
Light Water Reactor Sustainability

Understanding Materials Aging & Degradation is a Key Requirement for Subsequent License Renewal

- Increased lifetime leads to increased exposures to
  - Time at Temperature
  - Stress
  - Coolant
  - Neutrons
- Extending reactor life to 60, 80 years or beyond may increase susceptibility and *severity of known forms of degradation*
- New mechanisms of materials degradation are also possible (unknown unknowns)
  - ***Perform Gap Analysis***



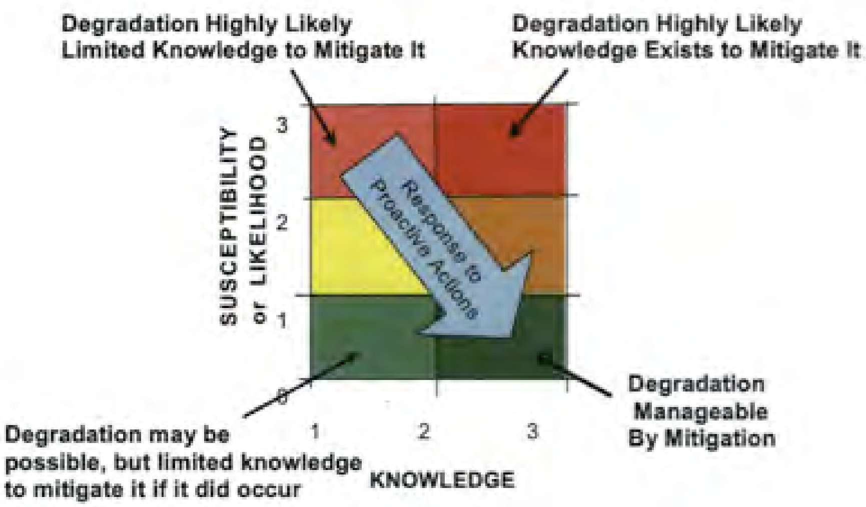
STRATEGIC GOALS:

- Develop the scientific basis for understanding and predicting long-term environmental degradation behavior of materials in nuclear power plants
- Provide data and methods to assess the performance of systems, structures, and components essential to safe and sustained NPP operations
- Develop means to detect and characterize aging degradation processes

Develop technologies for mitigation of key forms of degradation

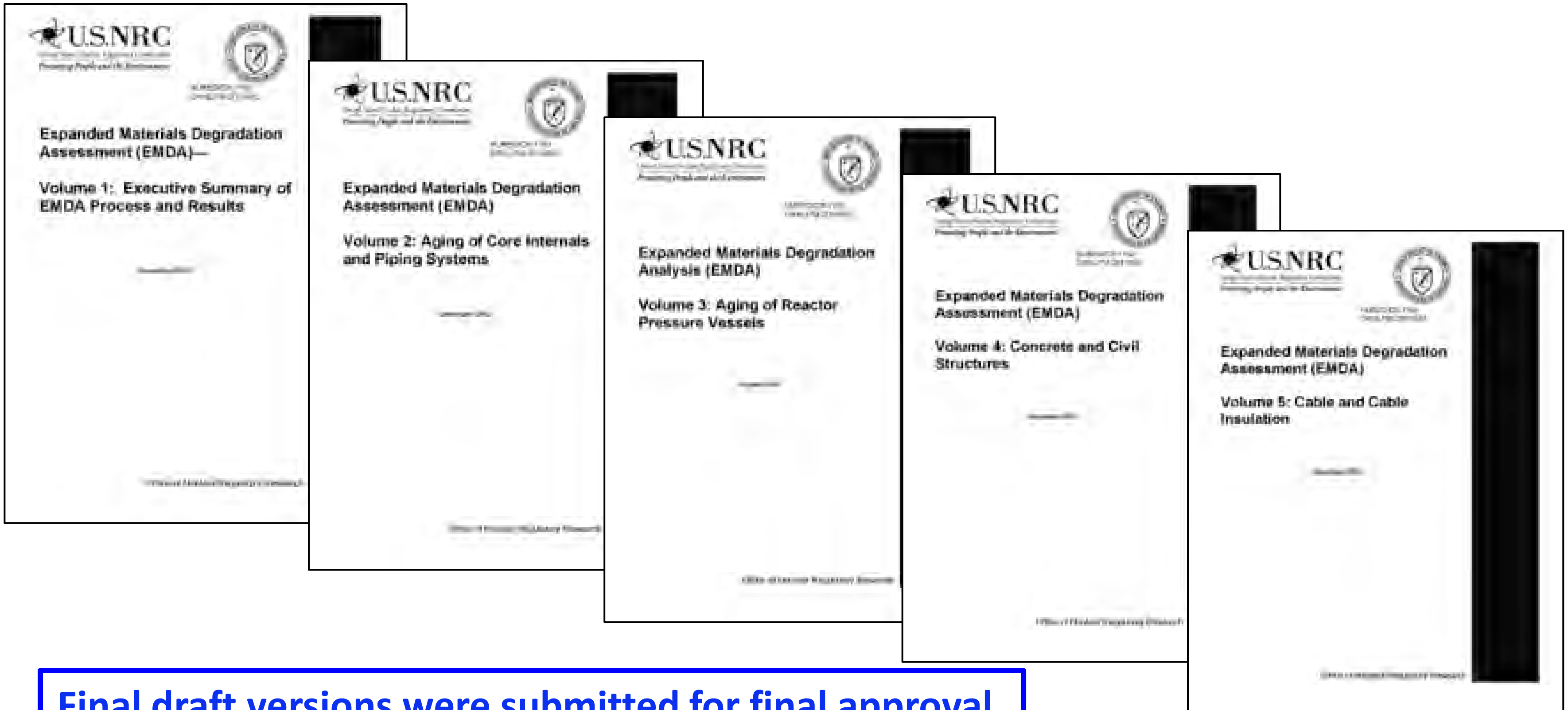
Given the complexity of the reactor systems and materials degradation, a prioritization tool for research was needed

- "Knowing the unknowns" is a difficult problem that must be addressed.
- This is a particularly difficult issue for such a complex and varied material/environment system.
- An organized approach similar to the US NRC's Proactive Materials Degradation Assessment (PMDA) (*NUREG/CR-6923*) has been utilized.
- Together with the U.S. NRC, the LWRS Program is working to expand the initial activity *to* encompass broader systems and longer lifetimes
  - Core internals and primary piping
  - Pressure Vessel
  - Concrete
  - Cabling



Proactive **M**aterials **D**egradation **A**ssessment Matrix

NRC and DOE have investigated issues of reactor aging beyond 60 years to identify possible knowledge gaps



Final draft versions were submitted for final approval and publication as a NUREG in December 2013. All technical issues resolved

LWRS
Light Water Reactor Sustainability

LWRS Materials Aging and Degradation research encompasses the entire plant

Concrete Degradation & Non-Destructive Evaluation(NDE)

Repair welding

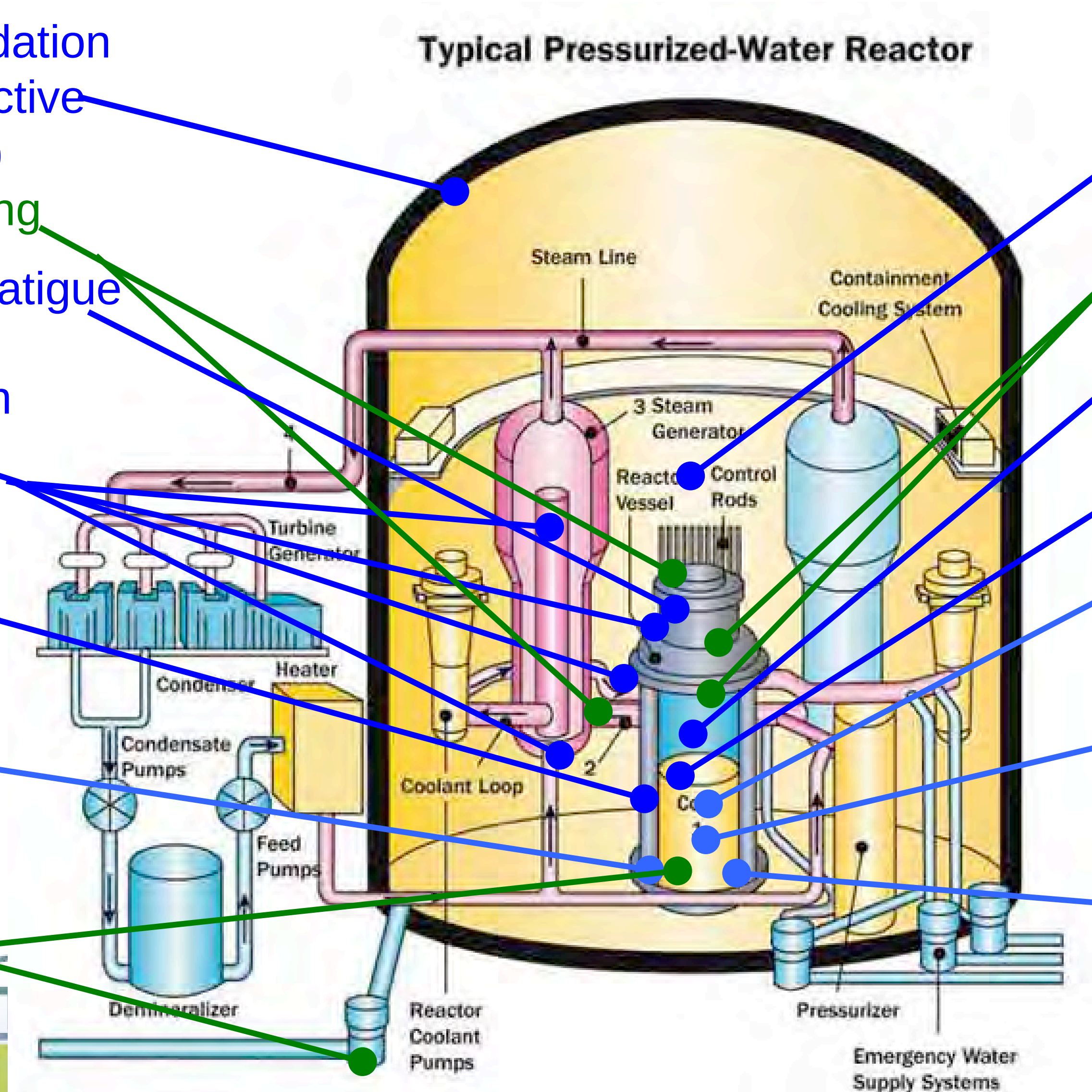
Environmental Fatigue & NDE

Crack initiation in Ni-base alloys & NDE

High Fluence effects on RPV & NDE

Surrogate materials and attenuation

Advanced replacement alloys



Analysis of cable degradation & NDE

Thermal annealing

Mechanisms of IASCC

High Fluence IASCC

Swelling of core internals

High fluence phase transformations

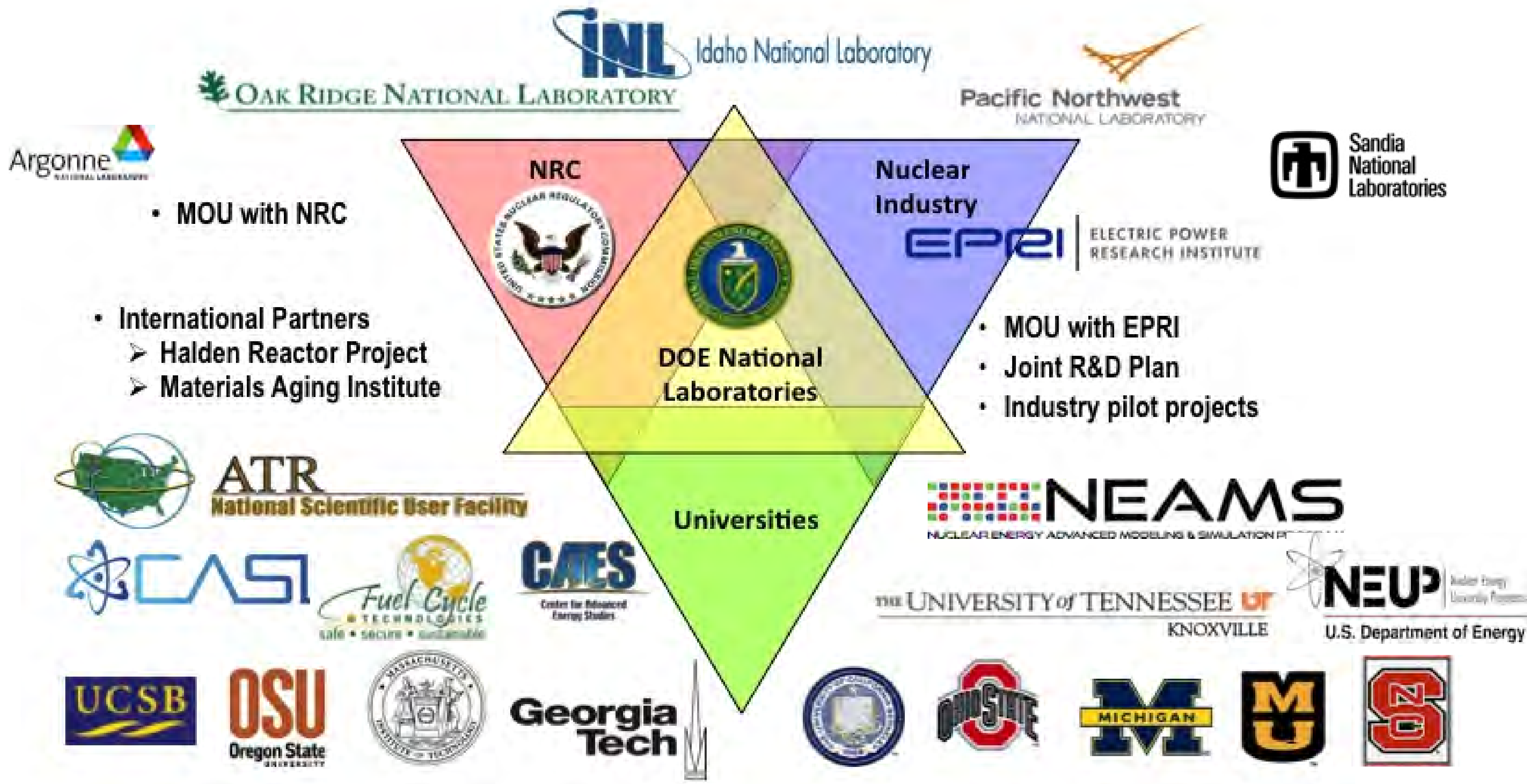
Cast Stainless Aging

Materials Aging and Degradation tasks provide results in several ways:

- **Measurements of degradation**: *High quality data will provide key information for mechanistic studies*, but has value to regulators and industry on its own.
- **Mechanisms of degradation:** Basic research to *understand the underlying mechanisms of selected degradation modes* will lead to better prediction and mitigation.
- **Modeling and simulation:** *Improved modeling and simulation efforts have great potential in reducing the experimental burden for life extension studies*. These methods can help interpolate and extrapolate data trends for extended life.
- **Monitoring:** While understanding and predicting failures are extremely valuable tools for the management of reactor components, *non-destructive monitoring will provide valuable data and insights*.
- **Mitigation strategies:** While some forms of degradation have been well-researched, there are few options in mitigating their effects. *New technologies may overcome limits of degradation in key components and systems.*

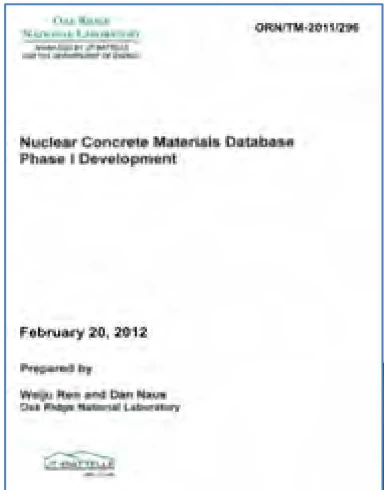
LWRS Light Water Reactor Sustainability

LWRS Program has a diverse set of partners



Concrete and Civil Structures Research and Concrete NDE

Nuclear Concrete Materials Database (NCMDB) and Irradiated Concrete


ORNL/TM-2011/296

Nuclear Concrete Materials Database
Phase I Development

February 20, 2012

Prepared by

Weiju Ren and Dan Naus
Oak Ridge National Laboratory

ORNL/TM-2011/296

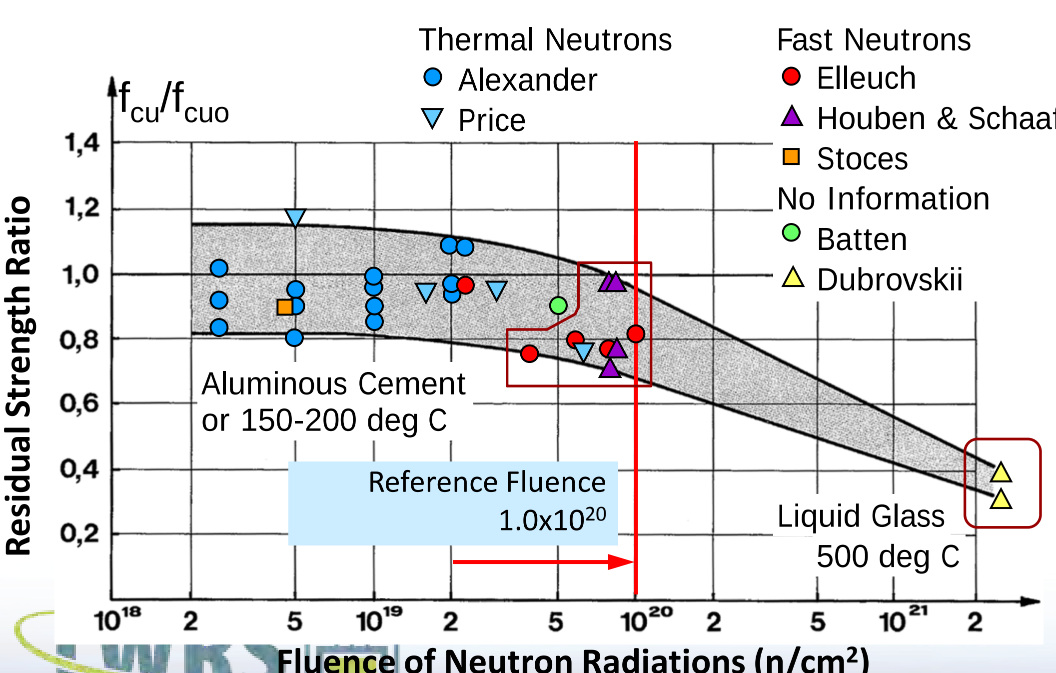
Concrete coring to obtain samples for evaluating effects of aging and environmental stressors

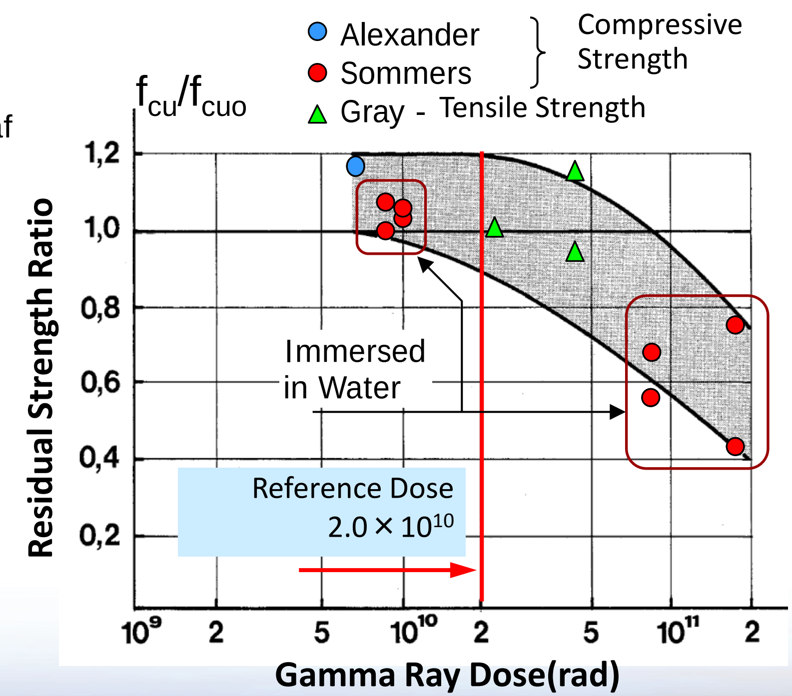
- **Phase I of NCMDB has been completed**
- Data and information for populating the NCMDB are from literature sources and testing samples from aged facilities
  - Aging
  - Elevated temperature
  - Irradiation
  - Migration of hostile species (e.g., Cl^-, SO_4, CO_2)
- **Concrete irradiation damage working group formed with EPRI**
  - Developed roadmap and multi-path strategy for addressing irradiated concrete issues.
  - Organized International Irradiated Concrete Information Exchange Framework Meeting (March 2014)

Interaction of Radiation and Concrete – Compressive Strength (I)

- **Experimental studies in literature have concentrated on specific strength reduction levels at specific levels of radiation intensity**
- **Much of testing was done in 1960's and 1970's using cube specimens having various compositions to study the effects of thermal-neutron irradiation**
- **Tests generally were performed on samples subjected to both neutron- and gamma irradiation, with few addressing gamma irradiation alone (difficult to produce gamma radiation without neutron)**

Critical exposure levels in Codes are generally based on experimental data collected by Professors Hilsdorf, Kropp & Koch (ACI SP-55, 1978)





[Kontani et al reevaluation]

Interaction of Radiation and Concrete – Compressive Strength (II)

- **Large Gaps in information:**
  - Neutron fluence cutoff energy (develop dpa model),
  - Composition of concrete (complex material),
  - Irradiation temperature,
  - Gamma-ray dose, etc.
  - Model to understand how radiation affects concrete

- **Applicability to NPP concrete is uncertain;**
  - More data needed
  - Better understanding and control of variables
  - Robust understanding of the effects of radiation

DOE – LWRS / EPRI – LTO Road Map for research to support irradiation effects of concrete

Knowledge Degradation mechanisms | **Assess and Manage degradation/rate** | **Safety margin assessment Structural significance**

Timeline

Mechanisms Understanding

- Prior Existing Knowledge 1960-2012
- γ-ray Irradiation on Cement Paste/Concrete at JAEA 2008-2015
- Effects of Heating and Drying at Nagoya 2013-2016
- Possibility of Aggregate Swelling Induced Damage 2013-2015
- Modeling Irradiation Effect on Concrete 2013-2015
- Possibility of IAASR In BSB/RVP support 2013-2015

Materials Characterization

- Harvesting Irradiated Concrete 2013-2017
- Accelerated Irradiation on Prototypical Concrete at Halden 2013-2016
- EPRI / LWRS Accelerated Irradiation Studies 2014 - 2016
- Post-Irradiation NDE at LANL 2015
- PIE at ORNL 2014-2017

NDE/Monitoring

- NLUT Examination of Thermally Damaged Concrete 2012
- Enhanced Instrumentation during Irradiation Test? 2014-2015

Engineering Validation

Structural Significance

- Operation Survey Bounding n fluence γ dose 2012-2013
- Radiation Transport Bounding n fluence γ dose 2012-2014
- Modeling Irradiation Effect on Bio-Shield Building 2014-2016

Key

- Prior Research
- DOE Actions
- EPRI Actions
- Third Parties Actions
- R&D gaps

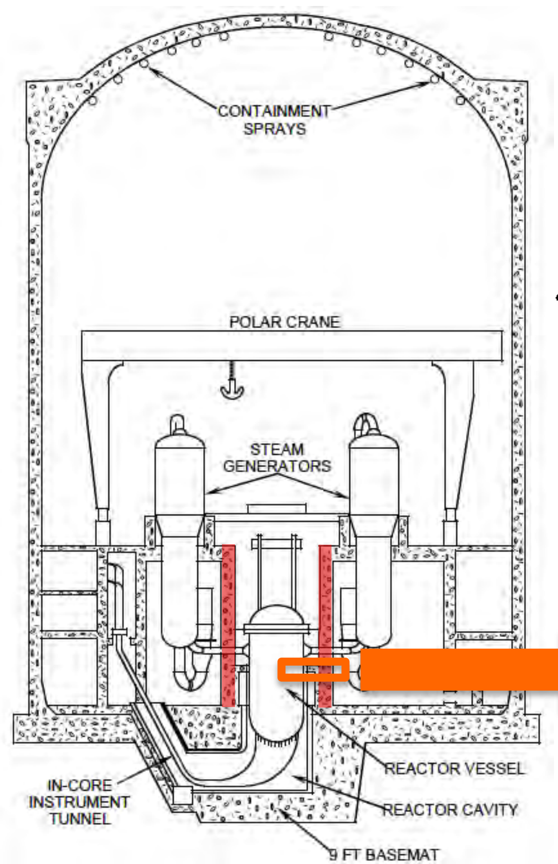
Effects of Radiation on Concrete: the LWRS Project Strategy

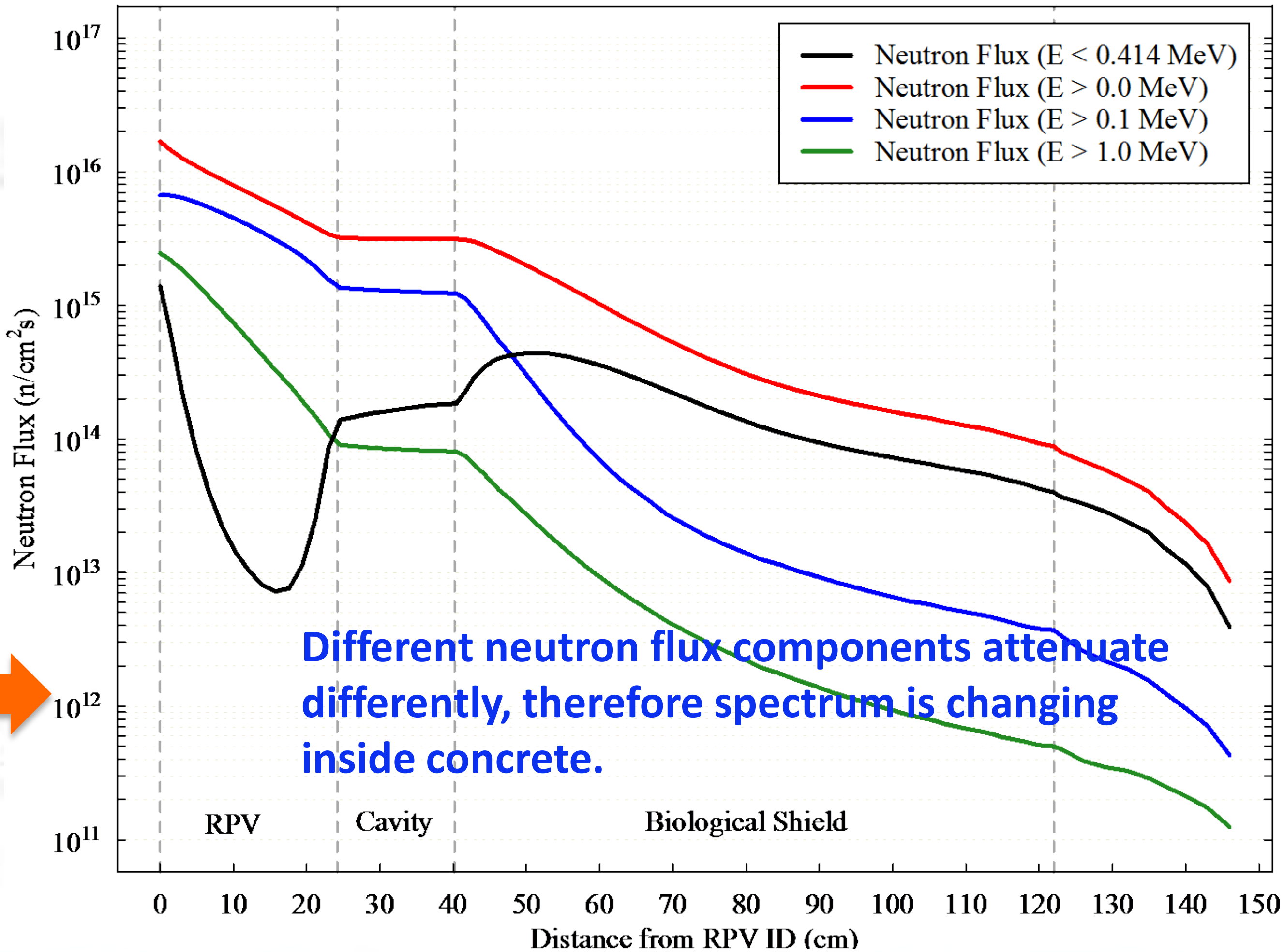
- **Characterize radiation fields in concrete structures in NPPs and determine the bounding values of neutron fluence and gamma-ray dose in the biological shield concrete at 80 years of operation and beyond.**
- **Obtain more data on the effects of neutron and gamma irradiation as well as extended time at elevated temperature on concrete.**
  - **Irradiate prototypical concrete to levels equal to or greater than expected in extended service (accelerated irradiation studies) and evaluate possible degradation.**
  - **Harvest and test irradiated concrete from decommissioned plants (US and international).**
- **Develop a more robust fundamental understanding of the effects of radiation on concrete.**
- **Establish a collaborative research effort with international partners.**

LWRS Light Water Reactor Sustainability

T. M. Rosseel, ORNL

Neutron Flux Profile Radially From the Reactor Core

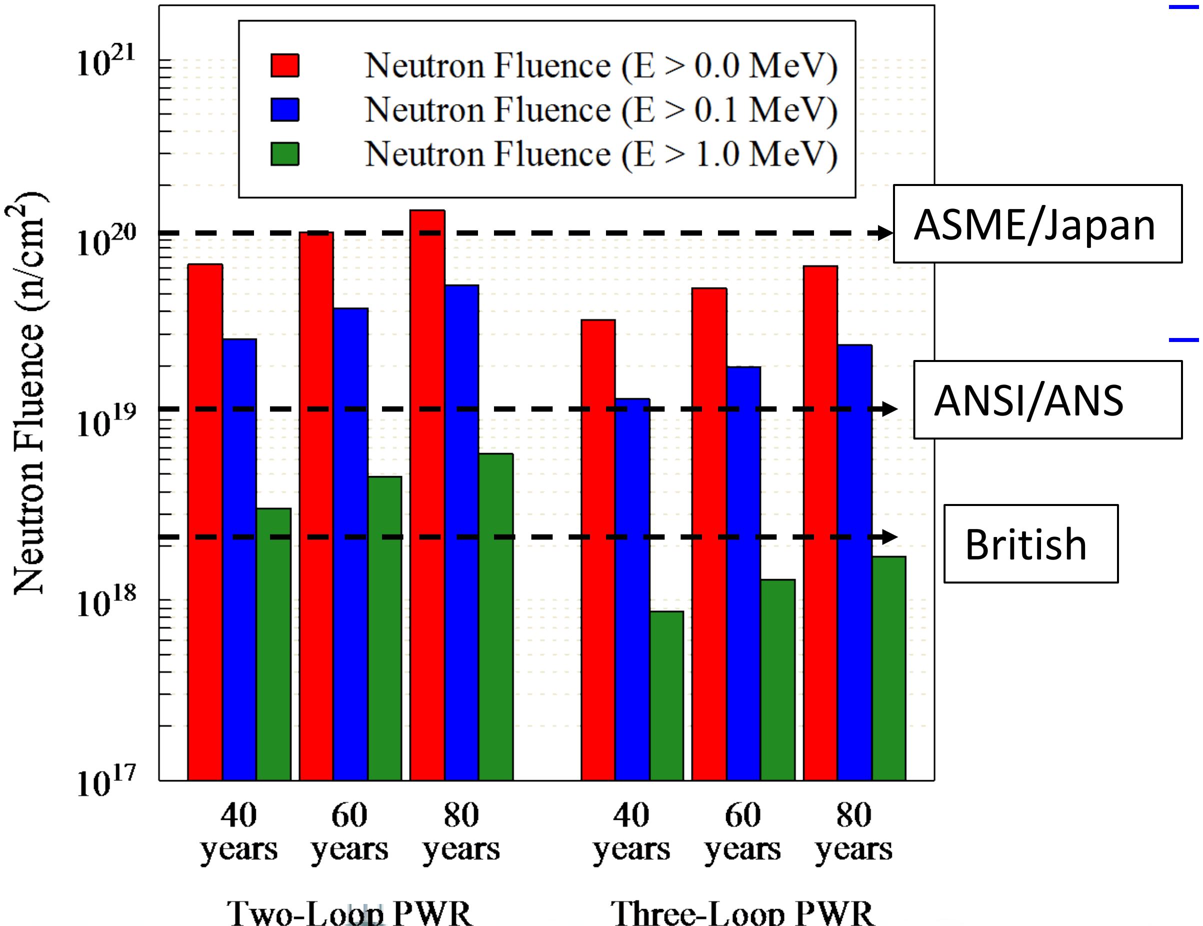




Distribution of neutron flux for given neutron energy cut-offs in a three-loop PWR in the radial direction from the core.

I. Remec, ORNL

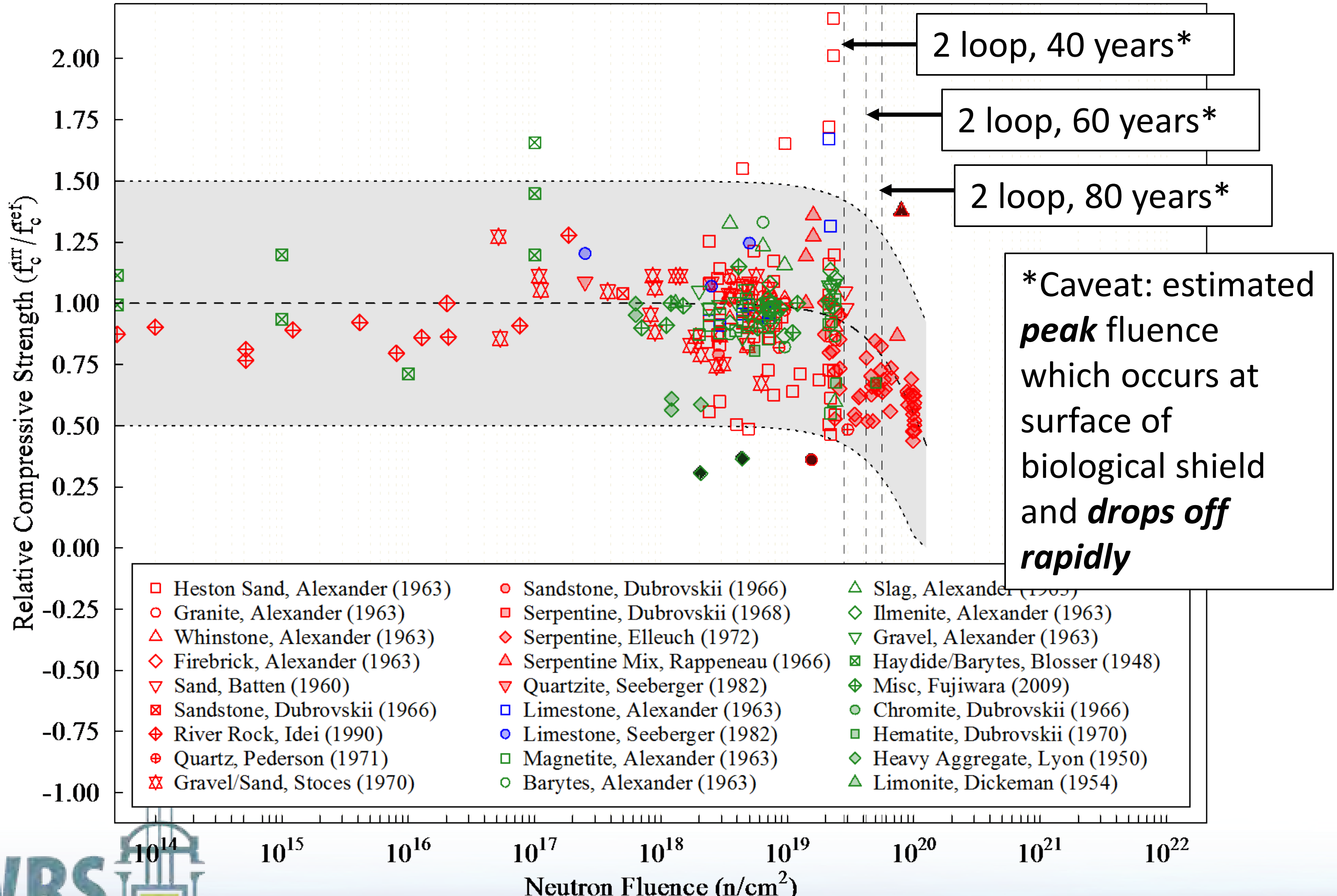
Variance of Expected Peak Neutron Fluences in the Bio Shield for Different Cut-off Energies



- **Values reported here serve as a guide, since fluence will change depending on plant configuration, fuel loading scheme, capacity factor, etc.**
- **Determining which energy cutoff, if any, is correct for the fluence determination is crucial for the assessment of the concrete degradation, in particular for the operation during extended plant life**

I. Remec, ORNL

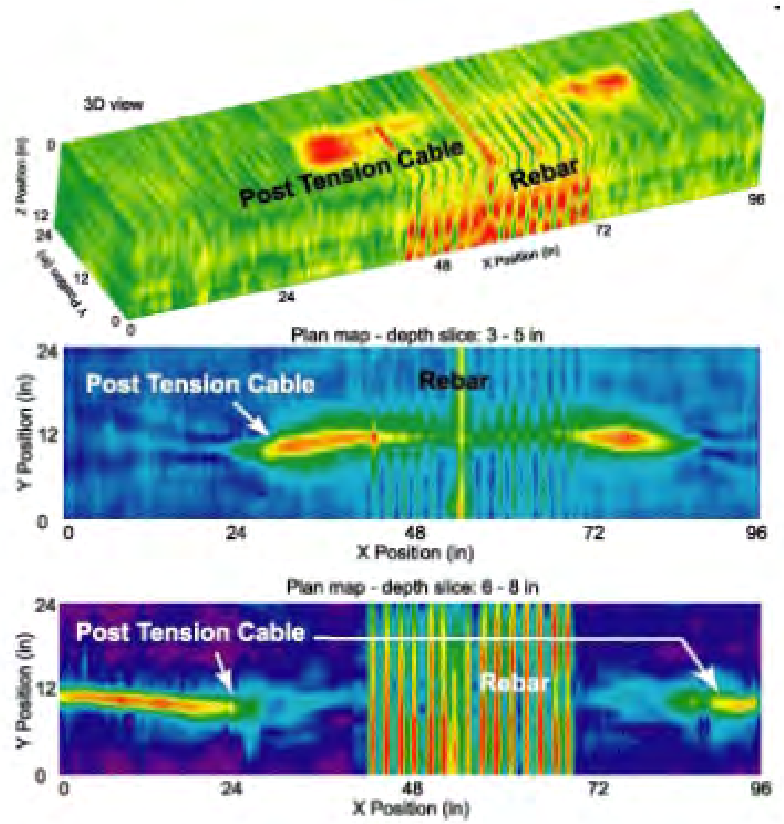
Re-examine compressive strength literature



K. Field, ORNL

NDE development is being integrated with materials research

- Continued work on crack and crack precursor detection development
- Developed NDE Roadmaps
  - **Concrete**
  - Cables
  - Fatigue damage
  - Reactor pressure vessel
- Roadmaps were assembled based on a variety of sources
  - Assessed key degradation modes
  - Interacted with materials experts
  - Assembled an expert panel and hosted a workshop
- Roadmaps are available on the LWRS website

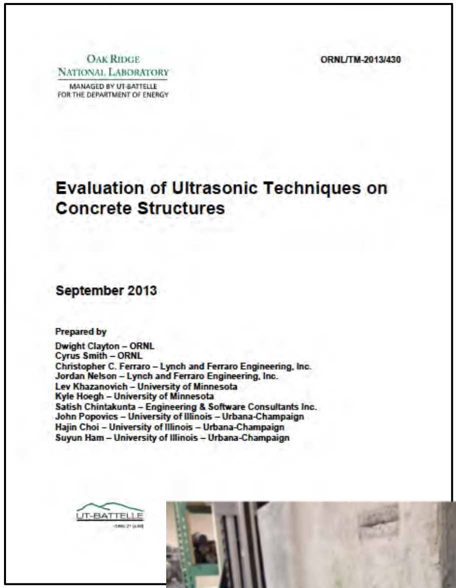


Ground Penetrating Radar

LWRS
Light Water Reactor Sustainability

Concrete NDE Techniques

- ORNL, the University of Minnesota, and Engineering & Software Consultants tested ultrasonic nondestructive examination techniques to perform volumetric imaging on thick reinforced concrete sections.
- Seven ultrasonic techniques were tested on specimens fabricated by the University of Florida for the Florida Department of Transportation’s nondestructive examination validation facility at their State Materials Office in Gainesville, Florida.
  - **Specimens included a rebar detection block and a void and flaw detection block**
  - **Generally, all techniques performed well on the two selected test specimens though each method has some limitations and shortcomings**
  - **Each technique has situations where it performs very well and other situations where it is somewhat lacking in performance, providing a baseline performance indication of each technique**
- The ultimate solution to volumetric imaging of a thick concrete section might be a fusion of data from various technologies



OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

ORNL/TM-2013/430

Evaluation of Ultrasonic Techniques on Concrete Structures

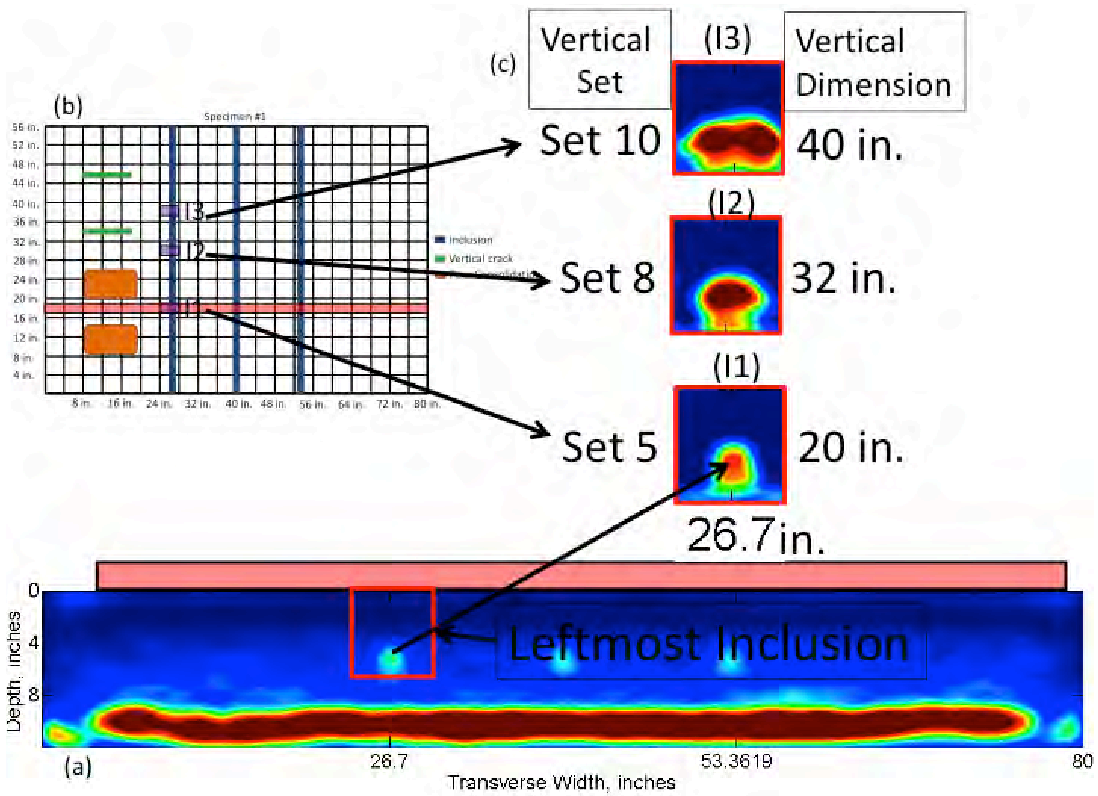
September 2013

Prepared by
Dwight Clayton – ORNL
Cyrus Smith – ORNL
Christopher C. Ferraro – Lynch and Ferraro Engineering, Inc.
Jordan Nelson – Lynch and Ferraro Engineering, Inc.
Lev Khazanovich – University of Minnesota
Kyle Hoegh – University of Minnesota
Satish Chintakunta – Engineering & Software Consultants Inc.
John Popovics – University of Illinois – Urbana-Champaign
Hajin Choi – University of Illinois – Urbana-Champaign
Suyun Ham – University of Illinois – Urbana-Champaign

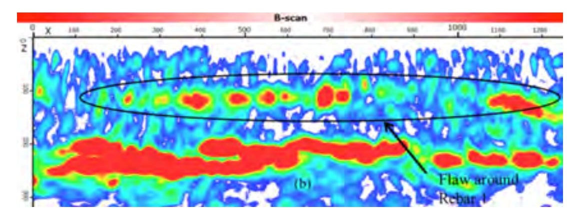
UT-BATTELLE

Ground Penetrating Radar Scans and Ultrasonic Scans of Concrete Samples Were Performed at the University of Florida

Using advanced signal processing techniques, additional details can be determined about embedded defects



Ultrasonic data with post-processing

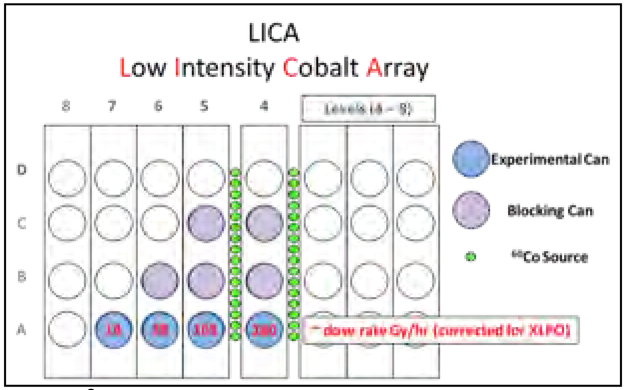


Original ultrasonic data

Cable Insulation Degradation

Cable aging research has focused on both service and lab materials

Finalized LICA Facility Updates

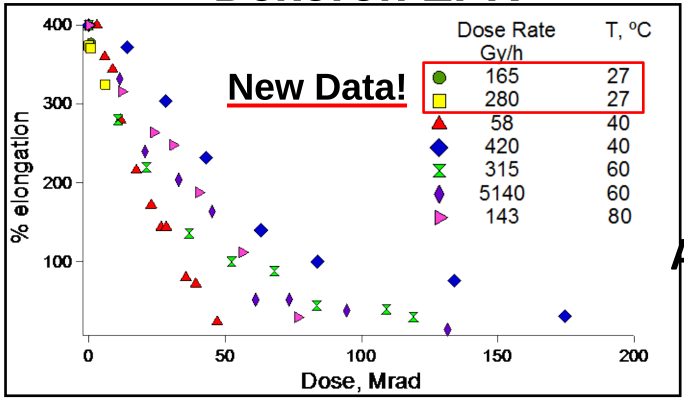


Performed Dosimetry and Updated Experimental Plan

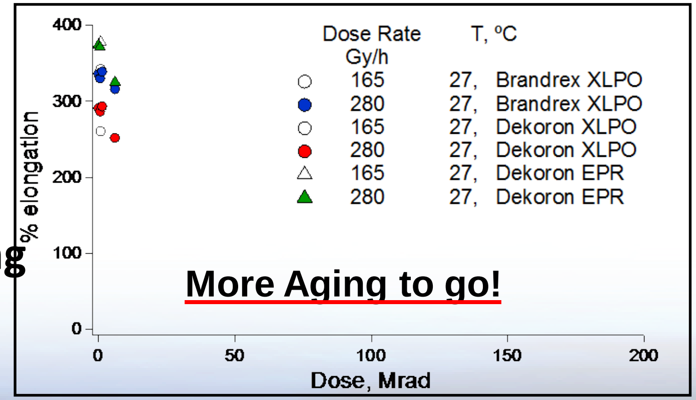
Initiated Long-Term Aging Experiments

Tensile Tested Virgin and Aged Specimens

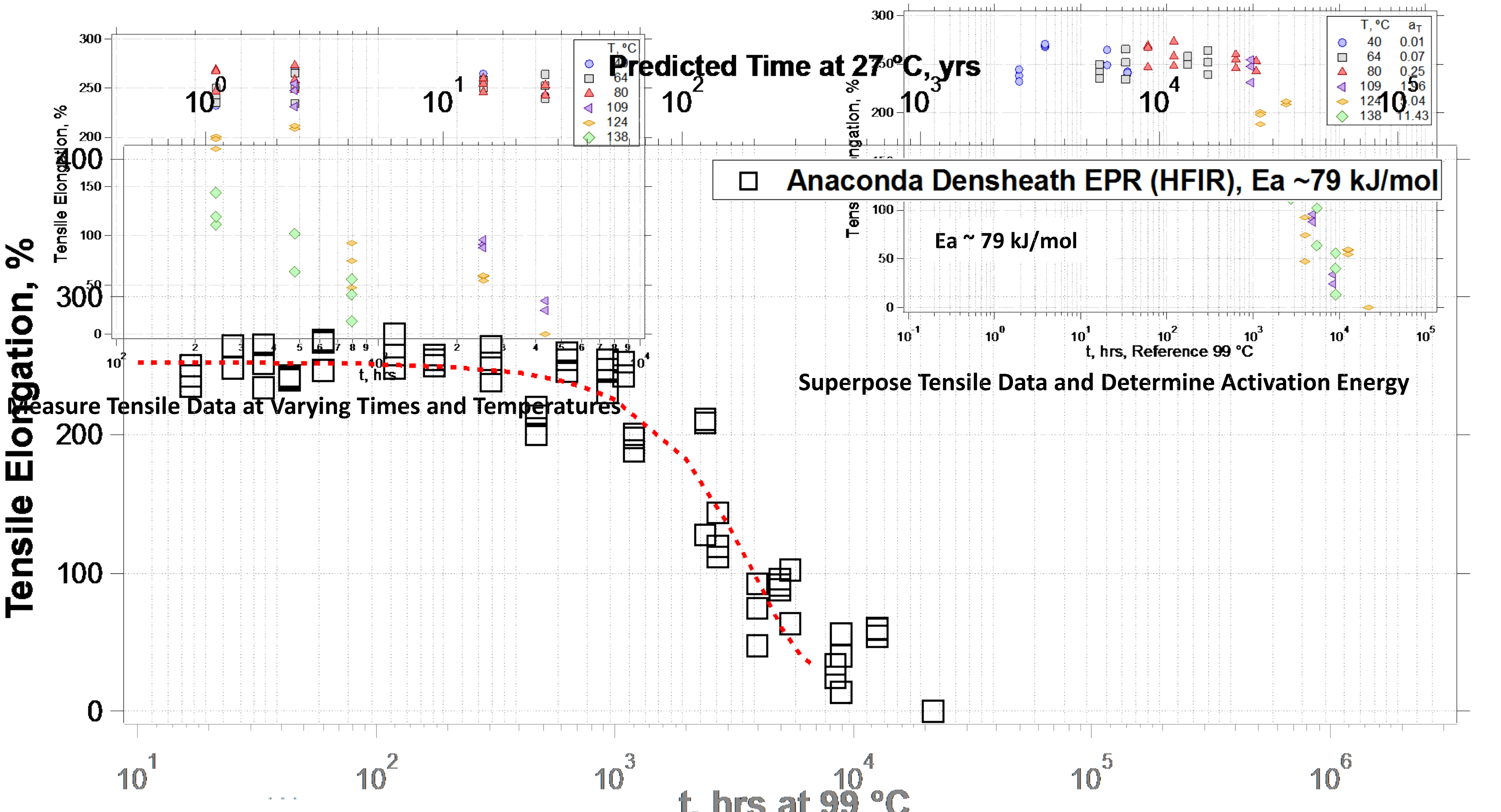
Dekoron EPR



Analyzed Aging Data



Accelerated aging has continued on service cable materials



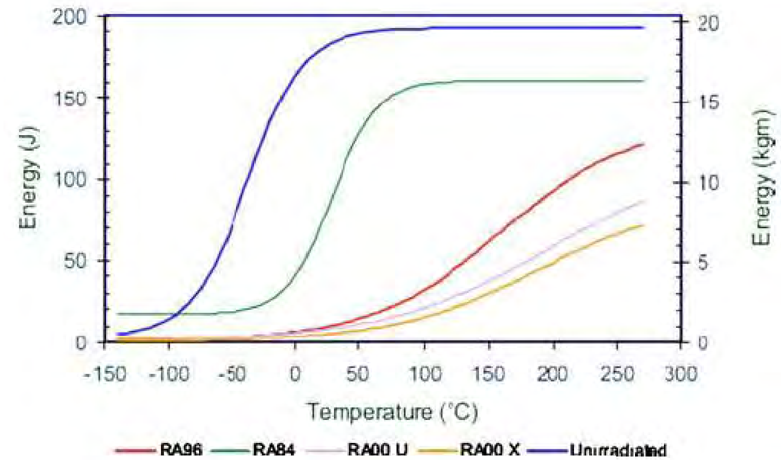
Anaconda Densheath EPR cables returned from service at HFIR at ORNL (~45 yrs of age, T_{avg} ~27 °C, RH ~70%). These cables were subjected to further thermal aging to elucidate their remaining tensile properties.

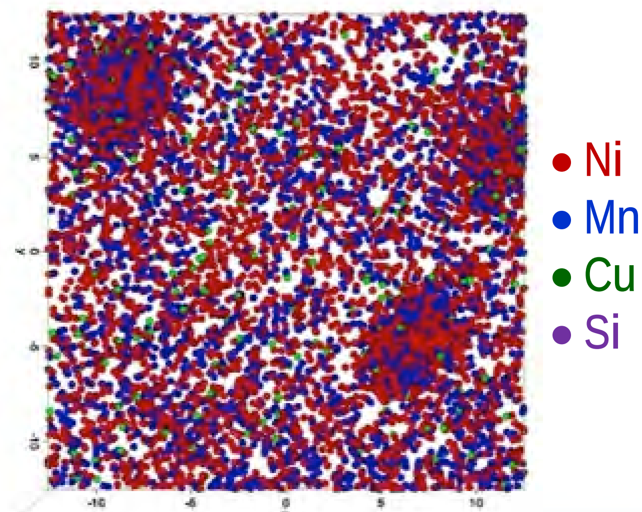
Reactor Pressure Vessel Steels

“Late Blooming Phases” have been the focus of RPV research

- Rapid Cu-rich precipitate hardening drives embrittlement of the reactor pressure vessel
- Modern RPV steels have low-residual Cu-levels
- **Irradiation may drive phase transformations even in low Cu alloys** (Odette et al.)
  - Mn-Ni(-Si-Cu) LBP that can reach large volume fractions and contribute to embrittlement
  - Could be important in low Cu steels thought to have little sensitivity to embrittlement
- RPV materials and surveillance specimens from the Ginna Nuclear Plant and from the Zion Nuclear Plants for material examination, APT, SANS, PAS

Embrittlement of low Cu weld Ringhals U4 from surveillance capsules

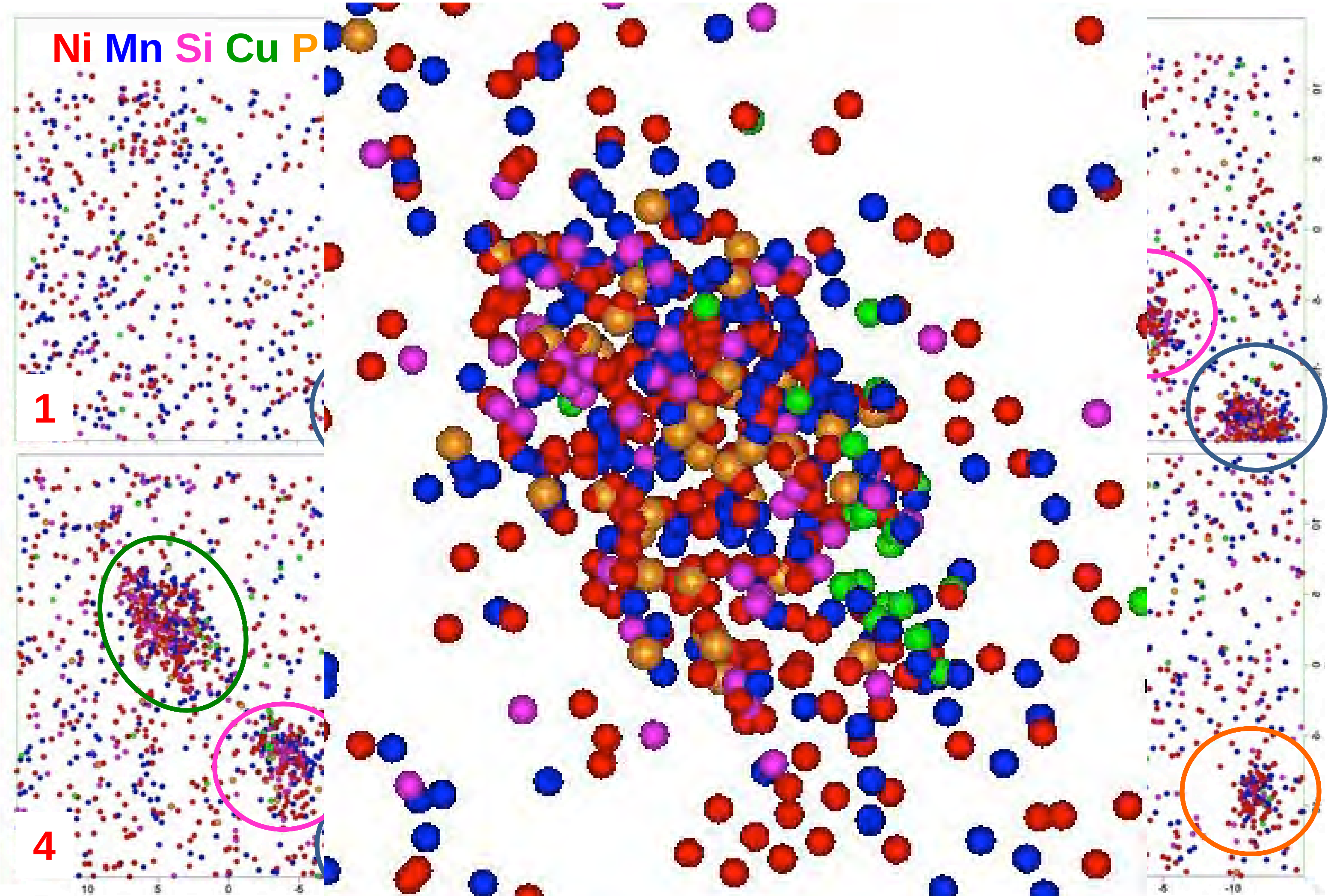




Low-copper (0.05 wt%) weld shifts 162°C at 6×10^{19}**, clusters primarily of** Ni-Mn-Si, very little copper.

R. K. Nanstad, ORNL

U3 Ringhals E6 surveillance weld: Atom maps - 1 nm slices



Fe (wt%)
0.08 Cu
1.58 Ni
1.46 Mn
0.54 Mo
0.21 Si
0.07 Cr
0.009 P
0.052 C

13.8 effective full power years

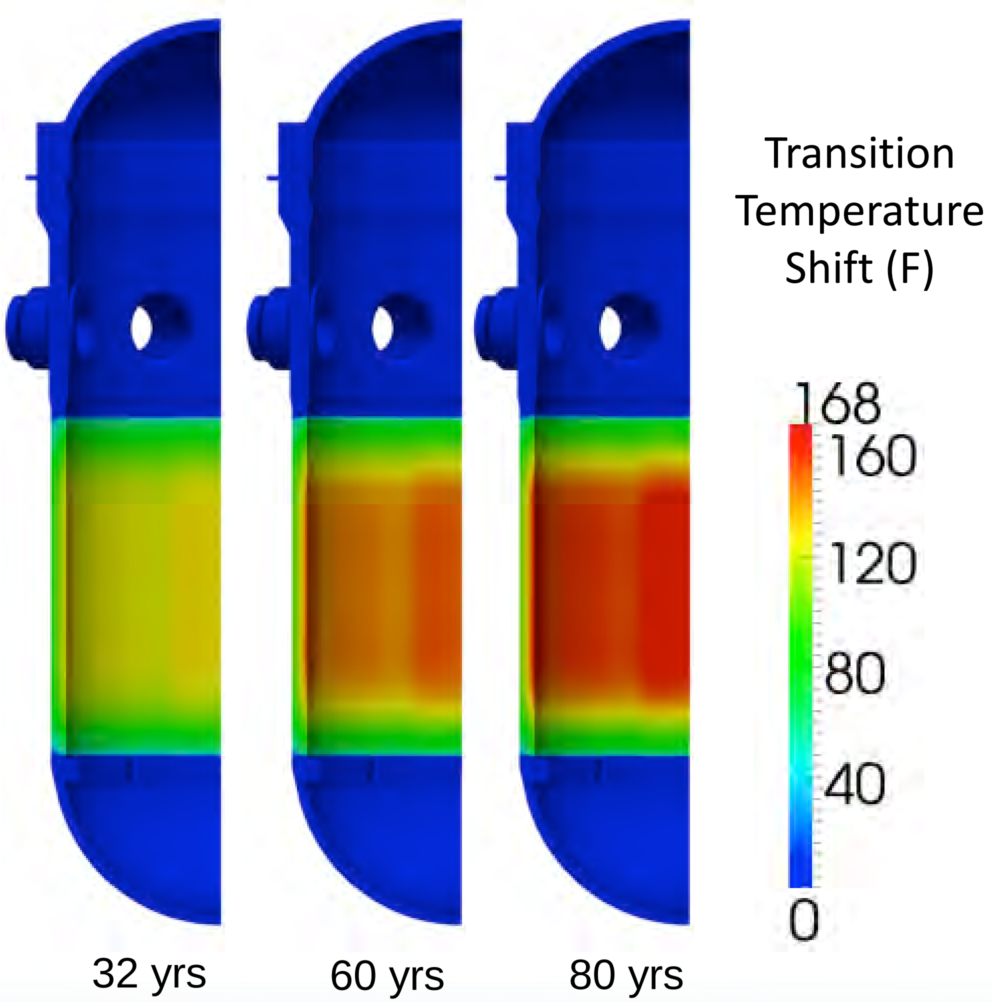
Atom map slices through 2-nm-diameter precipitates showing the solute distributions of Cu, Ni, Mn, P and Si within the precipitates.

High Ni and Mn, Low 0.08%Cu,
High fluence: 6.4 x10^{19} n cm^{-2}

M. K. Miller, ORNL

A new modeling tool is being developed to predict RPV degradation

- EONY model is used in a 3-D model of an RPV, Grizzly – to calculate change in temperature transition shift, over time and location.
- Application beyond 40 years is an extrapolation of experimental data. It will be updated for extended service with new mechanisms and data.
- It will incorporate weldments, heat affected zones, spatial variations in chemistry, and vessel cladding.
- Additional opportunities for collaboration between research tasks



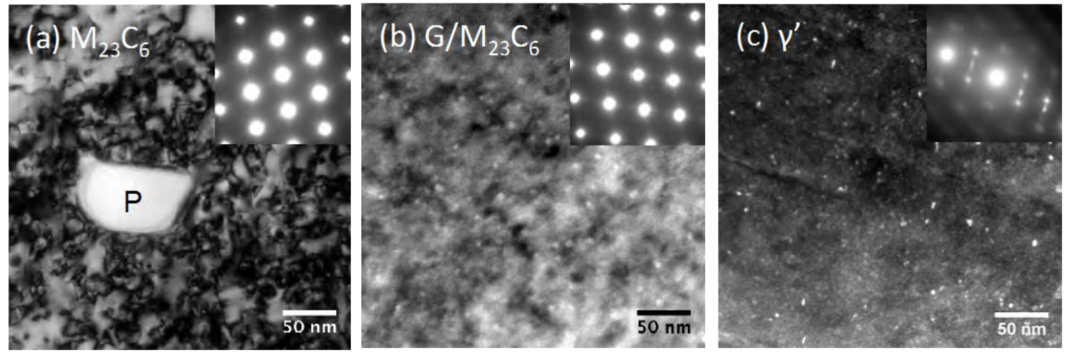
INL/ORNL/UT-K collaboration

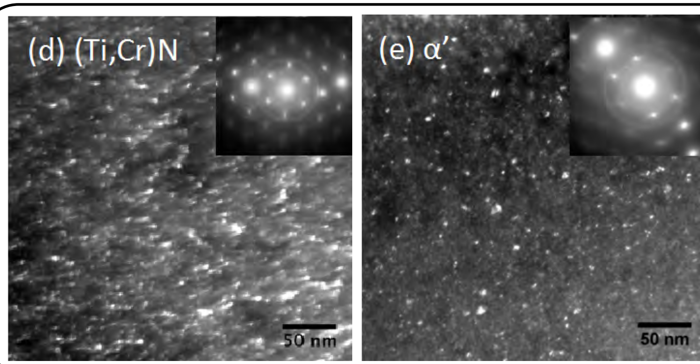
Radiation Effects

Radiation Resulted in Various Phase Instabilities

Formation of cubic-on-cubic **coherent precipitates**

(a) $M_{23}C_6$ in LS13 (9.1 dpa),
(b) G-phase/$M_{23}C_6$ in some samples,
(c) γ' (Ni_3Si-type) in BS13 (5.5 dpa).



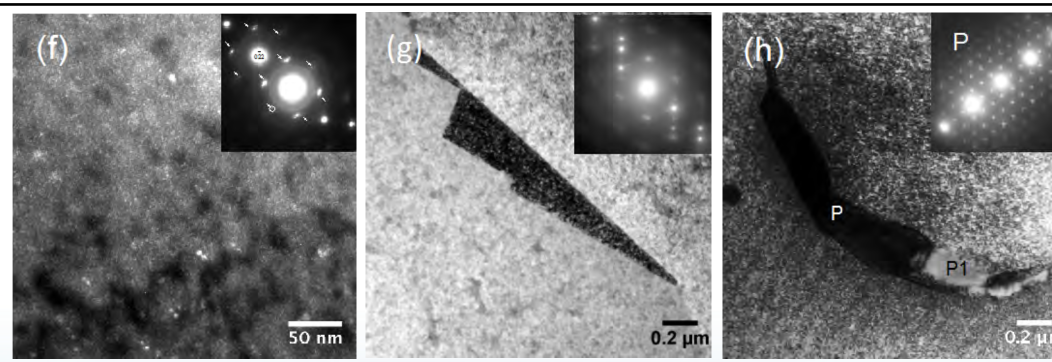


Formation of **incoherent precipitates**

(d) (Ti,Cr)(C,N) in some samples,
(e) α'-phase in FS13 (5.5 dpa).

Phase transformations of

(f) α-ferrite in AS18 (10.2 dpa),
(g) ε-martensite in SW37 (4.4 dpa),
(h) possible CrC from $M_{23}C_6$ (P) in LS13 (9.1 dpa).



Light Water Reactor Sustainability

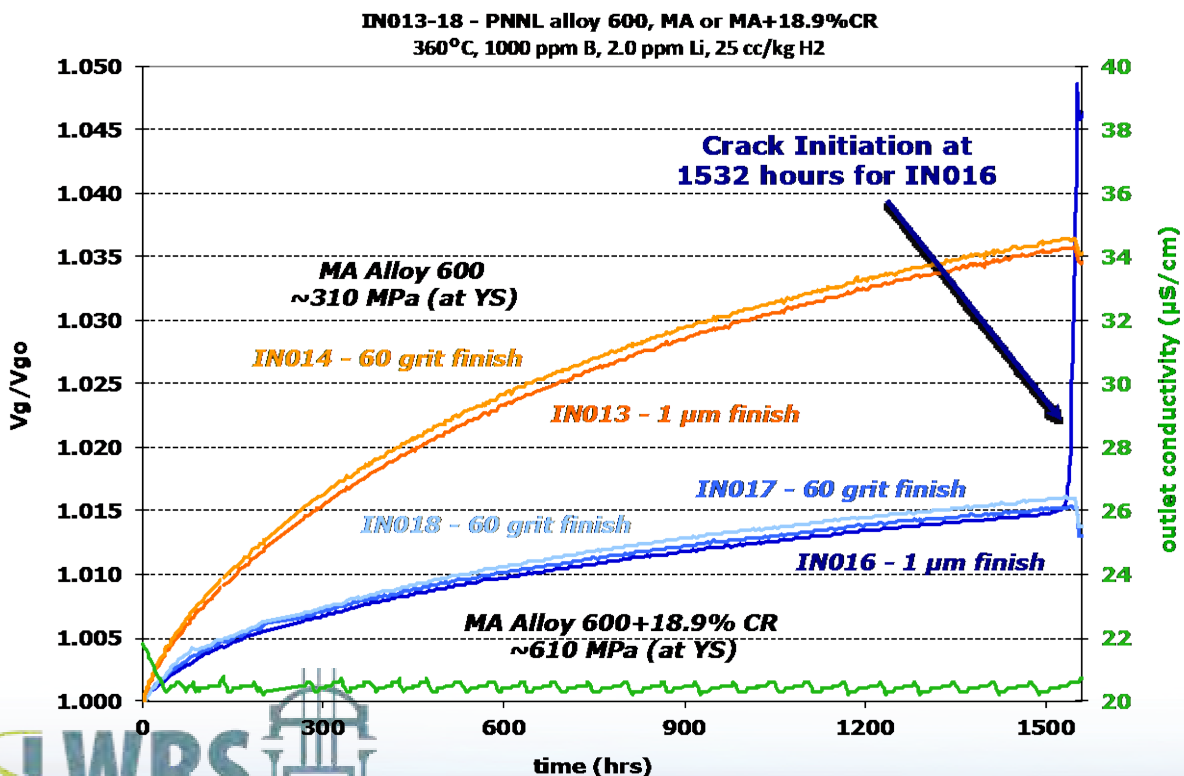
Analysis of irradiation-embrittlement in Ni-base alloys as part of the LWRS/Areva/EPRI partnership

Light Water Reactor Sustainability

Corrosion-related research

Multi-Specimen SCC Initiation Testing Demonstrated

The ability to quantitatively measure crack initiation in situ was demonstrated during constant load, SCC test on up to 30 tensile specimens using mill-annealed (MA) alloy 600 with various levels of cold work. Crack nucleation was detected on individual specimens, while test continued for other specimens.



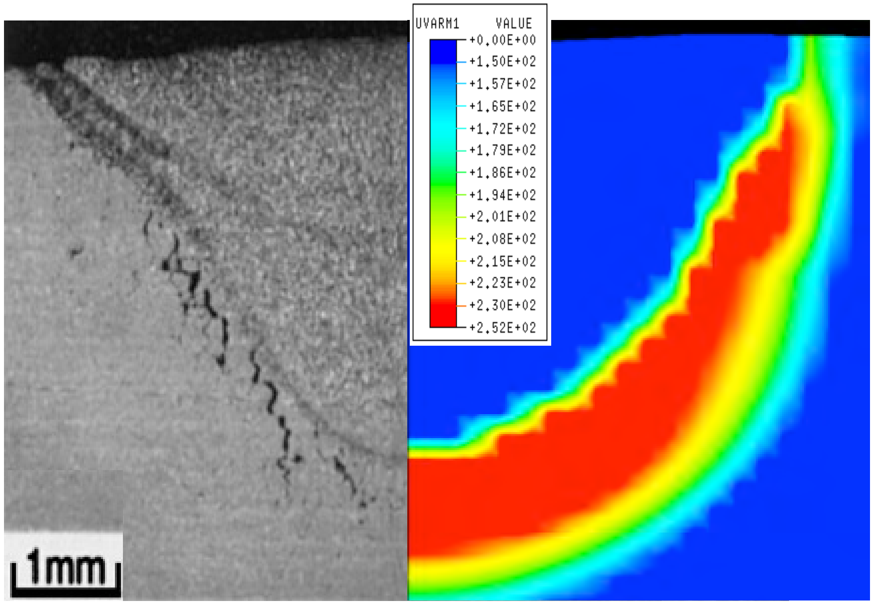
30 Specimen SCC Initiation Test System

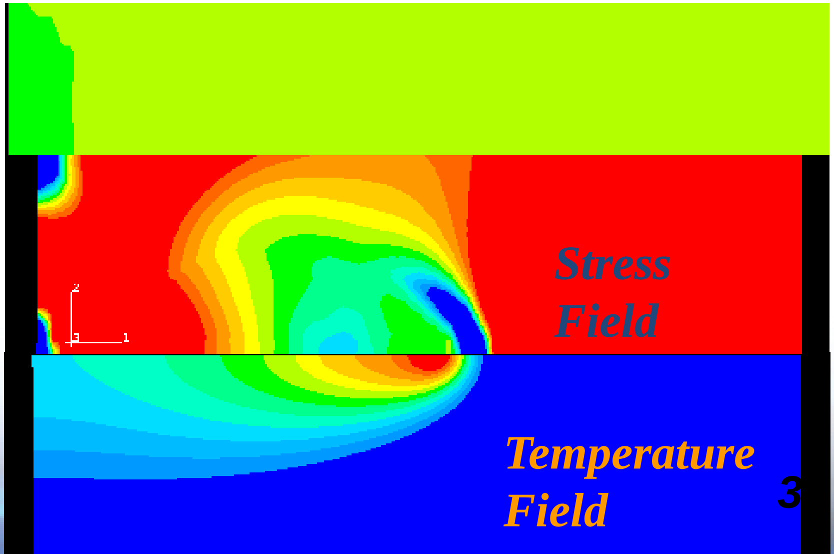
M. B. Toloczko and S. M. Bruemmer, PNNL

Mitigation techniques

Advanced welding R&D may provide solutions to long-standing areas of concern

- Residual stress-modeling provides insights into long-term performance and cracking resistance
- Current research in advanced weldments is jointly funded by DOE and EPRI
  - Survey of present art of hybrid welding processes
  - Advanced computational model for hybrid welding processes
  - Hybrid laser weld processing model to optimize the weldability of irradiated materials
  - Experimental methodology for direct measurement of transient high-temperature stress history during welding
- Technology is being developed with the direct expectation of transfer to industry in the near term

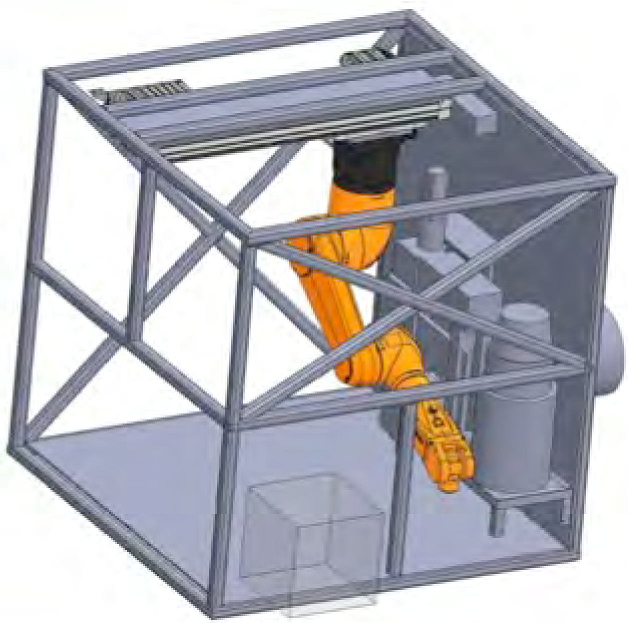




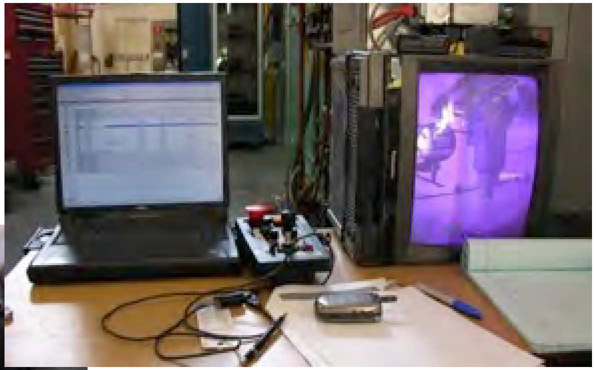
Z. Feng, ORNL

Design and Construction of A Dedicated Welding Hot Cell:

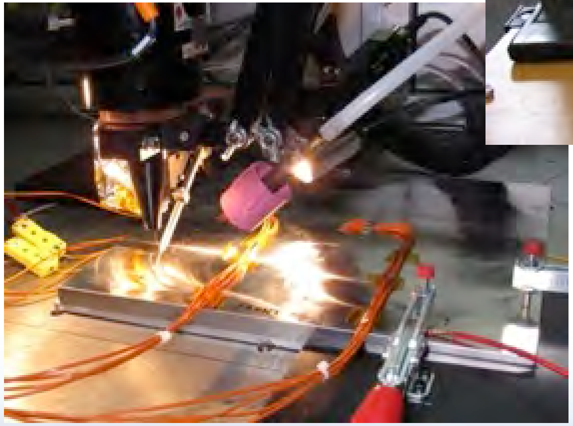
- First of its kind in the US. Part of an "one-stop" facility for R&D on irradiated materials to support DOE NE programs and industry's needs.
- Cost-shared with EPRI
- Switchable between different welding processes: laser welding, arc welding, and friction stir welding systems. Both LW and FSW can be remotely operated to reduce contamination issues of welding equipment
- In-situ temperature and stress measurement capability through remote optical system and unique measurement techniques
- System design has been completed. Individual hardware are being procured and tested



Exposed view of concept design of welding hot cell with robotic manipulators and friction stir welding system



Remotely operated FSW system to be integrated in the hot cell

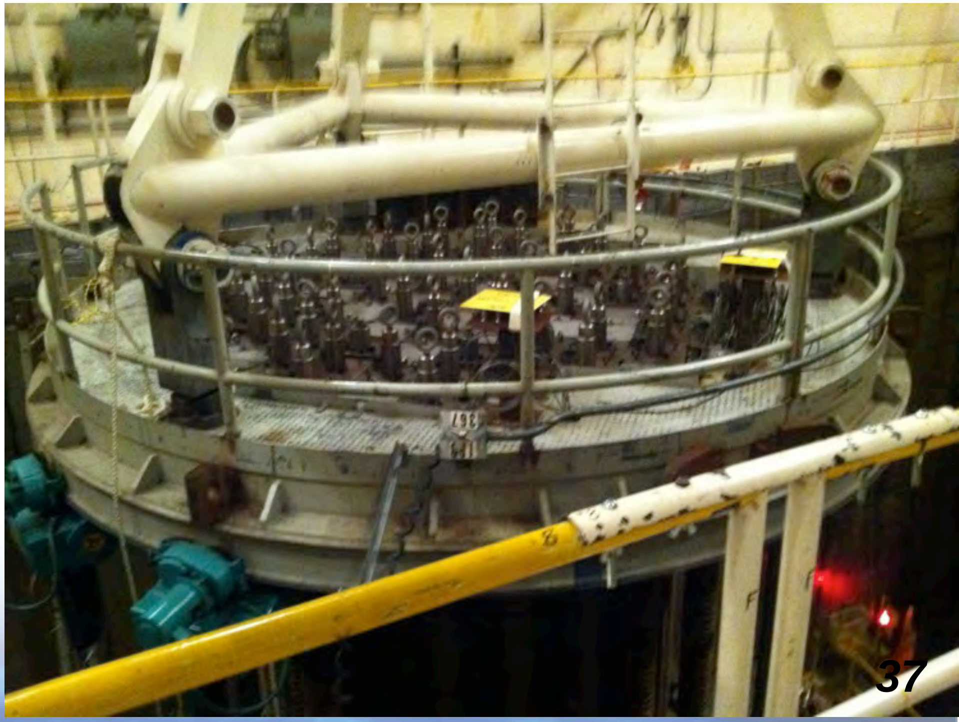


Laser welding system under testing and to be integrated in the hot cell

Integrated Research Activities

The Decommissioning of the Zion Unit 1&2 NPPs Provides a Timely Opportunity to Examine Service-Aged Materials Degradation

- In support of extended service (and current operations), ORNL is coordinating and contracting activities with Zion Solutions.
- In collaboration with the US NRC, EPRI, and others, a list of materials for "harvesting" has been compiled and feasibility examined.
- Structures and components of interest:
  - Thru-wall RPV sections
  - Cabling
  - Concrete bore samples



LWRS Light Water Reactor Sustainability

T. M. Rosseel, ORNL

Harvesting Zion Cables (I)

- **Objective is to obtain cables from Zion to help understand and predict cable degradation at extended lifetimes.**
  - **validate predictive models (based on accelerated aging studies) with empirical data obtained from field-aged materials and**
  - **provide greater confidence in the performance of cables during an accident with measurable indicators in lieu of relying on the current methodology of calculating service life based on environmental monitoring.**
- **Six CRDM cable bundles (Power, position indictor & thermal couple), were harvested in 2012. Joint NRC and LWRS effort.**

LWRS
Light Water Reactor Sustainability

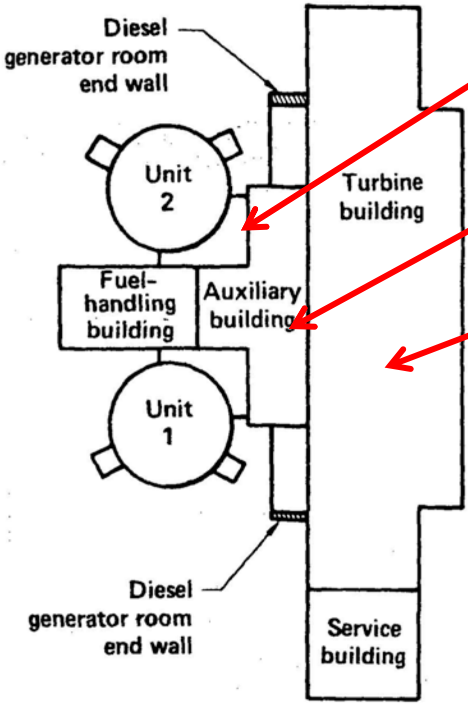
Harvesting Zion Cables (II)

- **Based on Zion site visit in August, 2013, (NRC and LWRS) identified cables for harvest. Request submitted January.**
  - **exposed to thermal and radiation environments, i.e. in-containment cables.**
  - **high thermal environments**
  - **benign controlled environment (e.g., the cable spreading room) that may provide a baseline for separating the effects of radiation and high thermal environments.**
  - **cables in submerged environments (e.g. tunnels between buildings)**

LWRS
Light Water Reactor Sustainability

Harvesting Zion Concrete Cores (I)

- Zion Irradiated Concrete Cores: Eight sets of 3 Concrete cores each were identified for harvesting during a site visit (12/9/13).



Cable spreading room

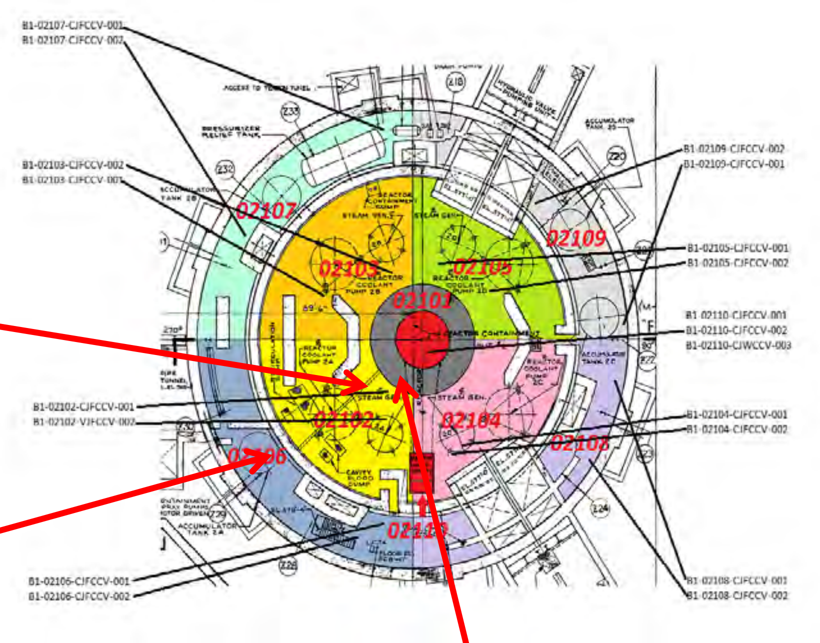
Center of Aux Bldg

Center of Turbine Bldg

Loop A (IMB) 2 elevations

Loop A (OMB) 2 elevations

U2 Containment Concrete Core Location Map



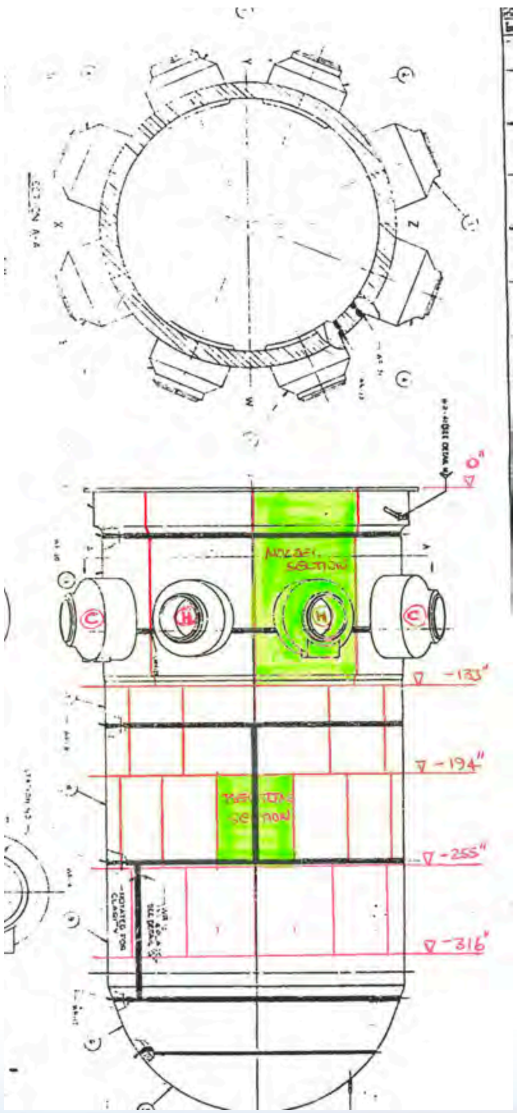
Biological Shield at 3 elevations (After RPV removed)

Harvesting Zion Concrete Cores (II)

- Cores were identified during December 2013 site visit for harvesting concrete cores for 8 locations from containment (Bio shield, IMB, OMB), Aux and Turbine buildings, and outside containment, below grade.
- The cores will be characterized at ORNL and possibly other locations to develop a better understanding of and ability to predict concrete degradation at extended lifetimes.
- **Research will be focused on (1) validating predictive models (based on accelerated aging studies) with empirical data obtained from field-aged concrete in radiation and thermal environments and (2) evaluating concrete radiation gradients (i.e. the biological shield) to investigate the changes in properties as a function of the level of radiation.**
- With the addition of concrete from ambient or controlled environments (e.g., the cable spreading room), it may be possible to separate the effects of radiation and thermal environments.

Harvesting Zion RPV Sections (I)

- Revised Zion Segmentation Plan:
  - 5' x 5' segments thermal cut instead of 3' x 4' diamond saw cut sections
  - Zion Unit 2: ~ 10/13 – 9/14 (tentative)
  - Zion Unit 1: ~ 10/14 – 8/15 (tentative)
- Ship by rail: intermodal container
  - Clam shell three sections to reduce shine
- LWRS Plan: Acquire 3 U2 sections:
  - 2 Beltline (SA-1769) and vertical weld (WF-70) sections
  - Cold Nozzle section to assess the so-called cavity albedo effect in collaboration with EPRI and CRIEPI (~ 5' x 10' section)



Harvesting Zion RPV Sections (II) Research Plan

- Access to service-irradiated RPV welds and plate sections will allow through-wall attenuation studies to be performed, which will be used to assess current radiation damage models. **Thermal cut must not cross HAZ of beltline weld**
- In collaboration with EPRI and CRIEPI, evaluate albedo flux effects in nozzles. Because a recent study suggests the attenuation profile in the nozzle is significantly different than that in the beltline region, a careful analysis of the effect of high fluence at extended lifetimes will provide critical data for the evaluation of RPV long-term operation.
- Option to perform NDE of sections (Offsite) and machine mechanical testing samples offsite (Energy Solutions Memphis facility)
- Sections of the segmented RPVs will be machined into test specimens from the Linde 80 (weld wire 72105) weld (RPV peak fluence < $1E^{19}$)
  - **CVN (Charpy V-Notch), Tensile, and Fracture toughness**

Zion Harvesting Summary

- Harvesting of materials from the Zion 1 & 2 NPP by the DOE, LWRS Program, in collaboration with EPRI, the NRC, and the US nuclear industry is providing invaluable access to materials for which there is little operational data or experience to inform relicensing decisions

- Research in coordination with other LWRS materials tasks, will provide an assessment of current degradation models to further develop the scientific basis for understanding and predicting long-term environmental degradation behavior.

- An opportunity that shouldn’t be missed.

Light Water Reactor Sustainability

Materials Aging and Degradation Pathway Summary

- **The DOE LWRS R&D program has initiated a national materials research effort to help provide fundamental and mechanistic knowledge to support extended reactor decisions.**
  - IASCC
  - RPV issues
  - Concrete
  - Cabling
  - Ni-base alloys
  - NDE
  - Mitigation strategies
  - Integrated research
- **Research is collaborative and well coordinated with partners around the world.**
- **High quality data (measurements) to mechanistic understanding to models to monitoring and mitigation**

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Discussion / Questions

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